Bucks County Intermodal Station Improvements
Levittown Station
R7 Trenton Regional Rail Line

Subconsultants:
Sowinski Sullivan Architects
I-T’AN YÜ and Associates
Reinaman Engineering Group
Nave Newell
ASC Group
# SECTION 00110

## SPECIFICATIONS

### TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Issue Date</th>
<th>Rev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Division 0</td>
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<td>List of Drawings</td>
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<td>Summary of Project</td>
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<td>Measurement and Payment</td>
<td>BID 1/30/15</td>
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<td>Cutting and Patching</td>
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<td>Field Engineering</td>
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<td>Regulatory Requirements and Safety</td>
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<td>Railroad Safety Requirements for Work on Amtrak Property</td>
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<td>Special Project Procedures</td>
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<td>BID 1/30/15</td>
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<td>Quality Requirements</td>
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<td>Testing and Inspection Services</td>
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<td>Construction Facilities and Temporary Controls</td>
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<td>Mobilization</td>
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<td>Temporary Construction</td>
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### Division 3 – Concrete

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### Division 5 – Metals

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<td>Flat Plastic Detectable Warning Tile</td>
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<td><strong>Division 7 – Thermal and Moisture Protection</strong></td>
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<td>Bituminous Dampproofing</td>
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**Division 10 – Specialties**

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| 16070 | Hangers and Supports | BID 1/30/15 | 0 |
| 16075 | Electrical Identification | BID 1/30/15 | 0 |
| 16120 | Conductors and Cables | BID 1/30/15 | 0 |
| 16130 | Raceways and Boxes | BID 1/30/15 | 0 |
| 16140 | Wiring Devices | BID 1/30/15 | 0 |
| 16150 | Wiring Connections | BID 1/30/15 | 0 |
| 16400 | Low-Voltage Distribution | BID 1/30/15 | 0 |
| 16410 | Enclosed Switches and Circuit Breakers | BID 1/30/15 | 0 |
| 16442 | Panelboards | BID 1/30/15 | 0 |
| 16510 | Interior Luminaires | BID 1/30/15 | 0 |
| 16525 | Site Lighting | BID 1/30/15 | 0 |
| 16530 | Emergency Lighting | BID 1/30/15 | 0 |
| 16730 | AVPA Systems for Heavy Rail | BID 1/30/15 | 0 |
| 16880 | Electric Resistance Heating | BID 1/30/15 | 0 |
| 16970 | Testing and Commissioning | BID 1/30/15 | 0 |

**Appendix**

**Appendix A** Site Boring Logs and Laboratory Test Results

END OF SECTION
## SECTION 00115

### LIST OF DRAWINGS

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A89  OVERPASS & TOWER WINDOW SCHEDULE  BID  1/30/15  0
A90  WINDOW & GLASS BLOCK DETAILS  BID  1/30/15  0

VT1  TECHNICAL DATA, CAR #1 INBOUND  BID  1/30/15  0
VT2  TECHNICAL DATA, CAR #2 OUTBOUND  BID  1/30/15  0
VT3  ELEVATOR PIT AND HOISTWAY PLAN CAR #1 INBOUND  BID  1/30/15  0
VT4  ELEVATOR PIT AND HOISTWAY PLAN CAR #2 OUTBOUND  BID  1/30/15  0
VT5  ELEVATOR CONTROL ROOM AND MACHINE AREA PLAN CAR #1 INBOUND  BID  1/30/15  0
VT6  ELEVATOR CONTROL ROOM AND MACHINE AREA PLAN CAR #2 OUTBOUND  BID  1/30/15  0
VT7  SECTION THRU ELEVATOR HOISTWAY CAR #1 INBOUND  BID  1/30/15  0
VT8  SECTION THRU ELEVATOR HOISTWAY CAR #2 OUTBOUND  BID  1/30/15  0
VT9  ELEVATOR ENTRANCE DETAILS CAR #1 INBOUND  BID  1/30/15  0
VT10  ELEVATOR ENTRANCE DETAILS CAR #2 OUTBOUND  BID  1/30/15  0
VT11  CAB ENCLOSURE DETAILS CAR #1 INBOUND  BID  1/30/15  0
VT12  CAB ENCLOSURE DETAILS CAR #2 OUTBOUND  BID  1/30/15  0
VT13  ELEVATOR FIXTURE DETAILS CAR #1 INBOUND  BID  1/30/15  0
VT14  ELEVATOR FIXTURE DETAILS CAR #2 OUTBOUND  BID  1/30/15  0
VT15  CAR AND COUNTERWEIGHT RAIL BRACKET DETAILS CAR #1 & #2  BID  1/30/15  0

S01  STRUCTURAL GENERAL NOTES  BID  1/30/15  0
S01A  SPECIAL INSPECTION NOTES  BID  1/30/15  0
S02  STATION GENERAL PLAN  BID  1/30/15  0
S03  FOUNDATIONS-ENLARGED FOUNDATION PLAN 1  BID  1/30/15  0
S04  FOUNDATIONS-ENLARGED FOUNDATION PLAN 2  BID  1/30/15  0
S05  FOUNDATIONS-ENLARGED FOUNDATION PLAN 3  BID  1/30/15  0
<p>| S05A | FOUNDATIONS-ENLARGED FOUNDATION PLAN | BID 1/30/15 0 |
| S06  | PLATFORMS-ENLARGED CAST-IN-PLACE LOW LEVEL PLATFORM PLAN | BID 1/30/15 0 |
| S07  | PLATFORMS-ENLARGED PLATFORM PLAN 1 | BID 1/30/15 0 |
| S08  | PLATFORMS-ENLARGED PLATFORM PLAN 2 | BID 1/30/15 0 |
| S09  | PLATFORMS-ENLARGED PLATFORM PLAN 3 | BID 1/30/15 0 |
| S9A  | PLATFORMS-ENLARGED PLATFORM PLAN | BID 1/30/15 0 |
| S10  | PRECAST CONCRETE PIER CAP PLANS, SECTIONS AND DETAILS | BID 1/30/15 0 |
| S11  | CONCRETE PIER CAP AND FOOTING PLANS, SECTIONS AND DETAILS | BID 1/30/15 0 |
| S12  | PRECAST CONCRETE WALL PANEL AND END OF PLATFORM, PLANS, SECTIONS AND DETAILS | BID 1/30/15 0 |
| S13  | PRECAST CONCRETE PLATFORM PLANS, SECTIONS AND DETAILS | BID 1/30/15 0 |
| S14  | PRECAST CONCRETE PLATFORM PANELS ELEVATION SCHEDULE | BID 1/30/15 0 |
| S15  | TYPICAL PLATFORM AND FOOTING SECTION | BID 1/30/15 0 |
| S16  | TYPICAL PLATFORM AND FOOTING SECTIONS | BID 1/30/15 0 |
| S17  | TYPICAL PLATFORM AND FOOTING SECTIONS | BID 1/30/15 0 |
| S18  | OUTBOUND PLATFORM RAMP SECTIONS AND DETAILS | BID 1/30/15 0 |
| S19  | INBOUND PLATFORM RAMP SECTIONS AND DETAILS | BID 1/30/15 0 |
| S20  | OVERPASS FOUNDATION SECTIONS | BID 1/30/15 0 |
| S21  | PLATFORM STAIR SECTIONS AND DETAILS | BID 1/30/15 0 |
| S22  | TEMPORARY PLATFORM PLAN AND SECTION | BID 1/30/15 0 |
| S23  | STATION BUILDING FOUNDATION PLAN | BID 1/30/15 0 |
| S24  | STATION BUILDING FLOOR PLAN | BID 1/30/15 0 |
| S25  | STATION BUILDING SECTIONS AND DETAILS | BID 1/30/15 0 |
| S26  | PLATFORM SECTIONS AND DETAILS | BID 1/30/15 0 |
| S27  | CANOPY FRAMING - TRUSSES AND BEAMS PLAN I | BID 1/30/15 0 |</p>
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PART 1  GENERAL

1.01 DESCRIPTION OF WORK

A. This specification covers separate prime contracts representing significant elements of work for each Contractor in the Bucks County Intermodal Improvements – Levittown Station. The work will be executed through multiple prime contracts representing significant elements of work for each Contractor. The Work shall be performed concurrently and in close coordination with the respective Prime Contractors listed in these construction documents, and possibly other trades working at the site as well as Amtrak and SEPTA. The Contractors for this project include:

1. Contractor for General Construction Work (to be known as "General Contractor" - GC).

2. Contractor for Mechanical Construction Work (to be known as "Mechanical Contractor" - MC).

3. Contractor for Electrical Construction Work (to be known as "Electrical Contractor" - EC).

4. The General Contractor shall be designated the coordinating contractor.

5. It shall be understood that when the contract documents use the term “contractor,” the information/responsibility shall apply to each prime contractor equally unless otherwise defined.

1.02 RELATED WORK:

Agreement
Section 01011: Summary of Project
Section 01025: Measurement and Payment
Section 01041: Project Coordination
Section 01060: Regulatory Requirements and Safety
Section 01400: Quality Requirements
1.03 QUALITY CONTROL AND QUALITY ASSURANCE

A. Each prime contractor will assume responsibility for executing a quality control and quality assurance program. This program’s basic form will be specified in his Quality Control Plan as submitted under Section 01400 and will include the tests and inspections called for in the technical sections of the specifications. Each prime contractor shall be responsible for requiring all subcontractors and suppliers to adhere to his quality assurance program and participate in quality assurance activities.

B. If a project is governed by “Buy America” requirements, SEPTA will require documentation to confirm the country of origin of all applicable products and materials. Each prime contractor is responsible for communicating Buy America requirements to his subcontractors and suppliers. The lack of sufficient documentation may be grounds for rejecting a product or material.

C. Quality activities will be documented by the contractor. SEPTA may audit the contractor’s quality assurance and quality control activities. Each prime contractor will make his and his subcontractor’s, applicable documentation available to SEPTA.

D. Each prime contractor, and their subcontractors, is required to cooperate fully with testing and inspection activities carried out by SEPTA and its agents. The contractor will provide the SEPTA PM with adequate (as determined by the SEPTA PM) notification, for all activities which require testing and/or inspection. For all inspections and testing required by code, work may not proceed until this testing and inspection has been completed.

E. Once a product or material has been accepted through the Submittal process, no substitution of this material or product will be allowed without resubmitting it following the provisions of Section 01300. SEPTA reserves the right to require removal of any non-reviewed material and product.

1.04 CONTRACTOR RESPONSIBILITIES

A. Furnish all materials, tools, equipment, supervision, administration, and transportation, and perform all labor and services necessary to furnish, deliver, construct, install, connect, and/or to interconnect and test as required to complete all work described in the Specifications and indicated in the Contract Drawings.

Each contractor shall be aware of, and be familiar with, the responsibilities and work of the other contractors especially with regard to the sections of Division 1, which pertain to all contracts. In addition to the responsibilities shared by each prime contractor, the coordinating contractor shall have additional responsibilities as specified in the contract documents.
B. Each prime contractor is responsible for securing and paying for all necessary permits and approvals required to complete the work. No work may commence on site without securing and paying for the necessary approvals including but not limited to:

1. Permits
2. Governmental Fees
3. Licenses
4. Other add appropriate reviews and approvals,

C. SEPTA Notification

1. Give written notices necessary for, and incidental to, the due and lawful prosecution of the Work.
2. Provide 10 days notification to SEPTA for all construction work which requires observation, testing and/or testing.
3. Notify the Project Manager at least 10 days in advance of the date the individual construction elements will be fully complete and ready for inspection.
4. Notify the Project Manager at least 10 days in advance of the date the entire work will be substantially complete and ready for inspection.
5. Notify the Project Manager at least 10 days in advance of the date the entire work will be complete and ready for final acceptance inspection.

D. Utility Notification

Known existing utilities may be indicated on the Contract Drawings but the contractor may not interpret this information as either complete or accurate. Regardless of those shown on the drawings, the contractor must identify and verify the location of all existing utilities prior to working by following applicable regulations and procedures, such as contacting the PA One Call system and asking SEPTA personnel to identify utilities at the site.

The contractor shall determine ownership of all utilities and notify utility owners prior to intended start work date. Deliver a copy of this notice to the Project Manager within 72 hours of the submittal of the notification.
E. Protection and Repair of the Work and Adjacent Property

1. Prior to the commencement of Work, the contractor and the SEPTA Project Manager shall examine the site and document the condition of all areas not intended to be changed by the project. Depending on the scope of work, this may include features such as sidewalks, driveways, roadways, and adjacent facilities.

2. The contractor must repair any damage to property caused, directly or indirectly, by the actions of the contractor to the satisfaction of the SEPTA Project Manager (and property owner if the damage is to property not owned by SEPTA) and at no cost to SEPTA.

3. Until Final Acceptance of the Work by SEPTA, the Contractor(s) shall be responsible for maintaining the executed work in its finished condition as determined by the SEPTA Project Manager. All work shall be restored to its finished condition prior to final acceptance at no expense to SEPTA.

F. Support of Existing Structures and Right of Way

1. Existing structures, adjacent to the project work area, must be supported adequately utilizing underpinning, shoring and other temporary stabilization measures. A plan to execute this temporary support and stabilization must be approved by the SEPTA Project Manager prior to any excavation. At the discretion of the SEPTA Project Manager, the contractor may be required to have this plan prepared and sealed by an appropriately licensed engineer.

2. Under no circumstances excavate in the vicinity of track, embankment and right-of-way without the prior approval of the SEPTA Project Manager and the Amtrak representative.

G. Contractor’s Field Staff

1. The Superintendent shall have demonstrated competency in the Work of the project.

2. Safety Officer: Each Contractor shall assign a designated on-site Safety Officer. The presence of the Safety Officer at the site is mandatory while work is being performed.

3. Quality Manager: Each Contractor shall assign a Quality Manager for the duration of the work. The Superintendent may perform the duties of the Quality Manager in addition to their own. For a definition of the responsibilities of this position see section 01400.

4. Project Coordinator
The Project Coordinator shall coordinate the prosecution of the Work with prime contractors, public utilities, Levittown Borough, Tullytown Borough, Amtrak, SEPTA Operations, and other contractors having access; The Project Coordinator will be responsible to either eliminate or minimize, as possible, delays in the Work and conflicts with those utilities, governmental bodies, and contractors. This coordination may include preparation of diagrams and delivery schedules, and control of site utilization, from beginning of construction activity through project closeout and warranty periods.

5. Staff Qualifications

The work of this contract requires specified experience in description of the specialized work of the contract. The positions referenced above are considered key personnel and the review of their resumes and experience is a responsibility requirement under paragraph 4d 6) of the Instructions to Bidders. The lowest bidder shall furnish SEPTA with the resumes for the people who will hold the above positions within five (5) days of receipt of SEPTA’s written request.

If, in the course of the work, these individuals are proposed to be replaced by the Contractor and/or SEPTA deems that their work is no longer satisfactory, the terms of the Paragraph VIII K of the Agreement will be invoked.

H. SEPTA Construction Sustainability Policies

SEPTA has adopted a series of sustainability policies which it expects its contractors to follow. These include but are not limited to the following:

a. Building Site Waste Management - Within 10 days of Notice To Proceed, and before any site work begins, the contractor shall submit a building site waste management plan. The plan shall specify which site debris shall be recycled, reused, or otherwise diverted. The goal of this plan shall be to reuse or salvage 75% of the land clearing debris including rock, trees, stumps and associated vegetation and 100% of excavated soils. Any materials which are disposed of off-site must meet all applicable regulations and be specifically approved by the SEPTA project manager. For material which is disposed of off-site, the contractor will be responsible for chain of custody documentation.

b. Material and Waste Management – Within 10 days of Notice to Proceed, and before any site work begins, the contractor shall submit a construction material and waste management plan. The plan shall specify which construction and demolition materials shall be recycled, reused or otherwise diverted. The goal of this plan shall be to divert 50% of
nonhazardous materials and waste (measured by weight or volume) from landfills unless the local municipality has designated a greater amount.

c. Sustainability documentation – All sustainability strategies which are fulfilled by the contractor’s actions must be documented to the satisfaction of the SEPTA Project Manager.

1.05 SEPTA RESPONSIBILITIES

A. SEPTA shall, furnish free of charge to the Contractor, one complete set of the Contract Documents including full size Contract Drawings, Specifications and Addenda, and/or conformed Contract Documents. SEPTA shall also furnish, electronically, one complete set of the Contract Documents as Portable Document Format (PDF) files. Additional copies may be made from the electronic files at the contractor’s expense.

B. Amtrak Force Account

1. Modifications to existing catenary and its attachment to support towers will be performed by Amtrak personnel. Repairs to concrete support tower foundations will be performed by Amtrak. Electrical bonding and grounding of the overpass structure will also be performed by Amtrak.

2. Any reprofiling of the tracks within the station that is required due to platform construction, construction of overpass foundations, or other impacts on the track profile will be performed by Amtrak at the expense of the General Contractor.

3. Installation of new inter-track fencing between the tracks within the new station platform limits and installation of new wooden platforms between tracks for access to trains for low-level walkways shall be performed by Amtrak. Materials to be provided by the General Contractor. Electrical bonding and grounding of fencing will be performed by Amtrak.

1.06 CONTRACTOR’S USE OF WORKSITE

A. Site availability and access to worksite:

1. The Contractor(s) shall confine operations at the site to areas permitted by law, ordinances, and permits according to the schedule and the Contract Documents and shall not unreasonably encumber the site with any materials or equipment.

The contractors shall obtain permits to enter Amtrak property.
2. Keep existing driveways, entrances, and exits serving the site, and facilities on the site, clear and available at all times, except as otherwise specified.

3. The contractor shall not interfere with SEPTA or public circulation by the storage or staging of equipment or material. SEPTA reserves the right to require the contractor to relocate equipment or material immediately and at any time even if the current location has been previously approved.

4. Keep the predefined portions of the worksite available for the SEPTA's operations during the construction period as noted in the construction phasing plan and other submittals. SEPTA reserves the right to take control of any part of the work at any time without prior notice.

5. Allow Amtrak access to Amtrak right-of-way at all times.

6. Allow Amtrak access to the outbound parking lot and the areas under the Fallsington Bridge at all times.


B. Storage of materials and equipment and deterring vandalism

1. Consider the safety of the Work, and that of people and property on and adjacent to the worksite, when determining amount, location, movement, installation, and use of materials and equipment on worksite. All storage and staging areas must be approved by the SEPTA PM.

2. Do not load finished Work with equipment and products that would endanger the integrity of the finished Work.

3. Move stored products as often as necessary if it interferes with foreseeable operations of SEPTA, public and private utilities, and other Contractors at no additional expense to SEPTA. Security of stored materials shall be the Contractor’s sole responsibility. Secure additional storage and work areas if needed for construction operations at no additional expense to SEPTA.

4. The contractor shall take precautions to prevent vandals from placing loose construction debris, supplies, and equipment into positions that might foul the track or otherwise interfere with the operation of SEPTA vehicles. These steps shall include, but not be limited to, securing movable items, like construction fencing and scaffolding, and storing debris and material in fenced and locked enclosures.
5. Failure to take adequate steps may result in the contractor having to go to the job site and secure these materials during non-construction hours, at no cost to SEPTA. SEPTA will hold the contractor responsible for any damage or injury caused, or contributed to, by failure to take these precautions effectively.

C. Protection of the Public and SEPTA

1. Protection the general public and SEPTA and Amtrak operations from construction-related activities shall always have the highest priority. Any work on streets or access ways which could affect traffic or pedestrian access must receive prior approval by SEPTA and other agencies as required by law. Conduct work on streets and access ways on SEPTA and Amtrak property in a manner, which will ensure that pedestrian and vehicular traffic will either not be obstructed or obstructed to the least possible degree. Employ appropriately trained and authorized flagmen where required by ordinance or to create a safe job site.

D. Construction operations requiring SEPTA or Amtrak service interruptions and/or utility interruptions must meet the following requirements:

1. Should any temporary disruption of SEPTA or Amtrak operations and/or use of the electric, water or telephone utilities at such site be necessary, it will be undertaken only pursuant to reasonable notices (not less than 30 days) given to the Project Manager and shall not continue beyond the previously agreed-upon period, without further written concurrence from SEPTA.

E. General Contractor to notify the local historical group noted below prior to demolition of the existing station and allow them to photograph the Levittown Train Station immediately prior to its demolition. General Contractor to remove and deliver the Levittown/Tullytown sign that is on the corner of Route 13 and the Levittown Parkway, and any other signage at the site to:

Mr. Simeon-David Marable
Levittown Exhibit Center North
283 Snowball Drive
Levittown, PA 19056
amx_12345@hotmail.com

F. The General Contractor shall notify the SEPTA Project Manager at least 60 days in advance from the date of removal of existing billboard signage. Demolition of such signage is prohibited without prior SEPTA approval.
1.07 SEPTA OPERATIONAL CONSTRAINTS

A. The work to be completed in each stage shall be performed based on work restrictions identified and shown on the Contract Drawings and specified herein. Work restrictions are defined as follows:

1. Concurrent track outages on tracks 1 and 4 are prohibited.

2. Unrestricted access. The Contractor has access to the work area at any time provided the work area is separated from train operations and the public by temporary partition walls with appropriate noise and dust protection as specified in Sections 01060, 01141A, 01103A, 01142A, 01520A, and 01500 and as approved by SEPTA.

3. Access during a weekend single track outage. With proper notification as described in Section 01103A, SEPTA will operate single track train service on weekends beginning approximately 11:00 PM Friday and continuing to approximately 4:00 AM Monday to perform work on the station platform. Coordinate all requests for single track weekend train operations with SEPTA’s Project Manager. Erect temporary barricades in accordance with the specifications prior to beginning work. Ground catenary, signal, and transmission lines.

4. To facilitate the Work of this contract, track outages, and “Night Owl” work will be required during each phase of construction to complete the Work. These outages will be limited to specific time durations, conditions, and impacts as specified and approved by SEPTA and Amtrak. Procedures for requesting track and power outages, protection services, and SEPTA/Amtrak equipment are specified in Section 01103A. It is the Contractor’s responsibility to request these outages and perform all work required to complete the project in accordance with the Contract Documents and approved CPM schedule. Erect temporary barricades in accordance with the specifications prior to beginning work. SEPTA/Amtrak will provide the following outages, pursuant to the phasing indicated in G-004, G-005, G-006, G-007 & G-008:

a. Outage Type A - Phase 1

1. **Duration**: 9 months
2. **Outage**: None anticipated. Nighttime single track outages (#1 or #4) 1:00 AM to 5:00 AM if any are required.
3. **Work**: Parking lot construction IB southern and OB, Levittown Parkway Driveway relocation and PECO relocations.

b. Outage Type B - Phase 2

1. **Duration**: 18 months
2. **Outage**: Single track outages on #1 or #4, 11:00 PM to 5:00 AM weeknights, 9:30 PM to 9:30 AM weekends.

3. **Work**: Staged demolition and station construction, excavation & foundation work, installation of pre-cast high level platforms, stairs to platforms, canopies, roofing, ramps, and railings.

c. **Outage Type C - Phase 2**

1. **Duration**: 4 weekends
2. **Outage**: Two weekend nights each, 1:00 PM - 5:00 AM, either EB (#1 & #2) or WB (#3 & #4) tracks out of service (OOS), catenary power, overbuild transmission & signal power out on OOS side.
3. **Work**: Bridge support steel erection - lift in bridge support steel - prepare for lifting bridge into position - one weekend per side - Amtrak to evaluate exact track outage requirements.

d. **Outage Type D - Phase 2**

1. **Duration**: 1 night
2. **Outage**: One weekend night (1:45 AM - 3:45 AM) - All 4 tracks OOS. All Catenary power out. All overbuild transmission & signal power out except one transmission line. Immediately preceding and following the 4 track outage, tracks may be progressively taken out of and returned to service pursuant to Outages Type B, C & E.
3. **Work**: Main bridge erection outage - lift bridge in over transmission lines lower into position between overbuild and catenary, rotate into position.

e. **Outage Type E - Phase 2**

1. **Duration**: 4 weekends
2. **Outage**: Two weekend nights Each (11:00 PM – 5:00 AM) - both EB (#1 & #2) or WB (#3 & #4) tracks OOS, catenary power, overbuild transmission & signal power out on OOS side.
3. **Work**: Erect stair towers - lift in stair support steel and stair enclosure frames, one weekend per side, Amtrak to evaluate exact track outage requirements.

f. **Outage Type F - Phase 3**

1. **Duration**: 9 months
2. **Outage**: Single track outages on #1 or #4, 11:00 PM to 5:00 AM weeknights, 9:30 PM to 9:30 AM weekends.
3. Work: Station construction, excavation and foundation work. Installation of pre-cast high level platforms, stairs to platforms, canopies, roofing, ramps, and railings.

g. Outage Type G - Phase 3

1. Duration: 6 months
2. Outage: None
3. Work: Continued parking lot improvement and project wrap-up.

B. Do not begin construction activities that may interfere with SEPTA and Amtrak operations and passenger movement until:

1. The Contractor provides a written “Site Specific Work Plan (SSWP)” to SEPTA indicating impact to passenger flow and SEPTA operations. Such plan shall include remedial solutions acceptable to SEPTA. Submit the plan at least 30 days prior to proposed implementation.

2. The SSWP is approved in writing by SEPTA. The Contractor shall be responsible for revision and reimbursement of the plan until approved by SEPTA.

C. Typical SEPTA and Amtrak Operations are described as follows:

1. SEPTA passenger trains on the Trenton Line operate 20 hours per day, from 5:00 AM to 1:00 AM, on weekdays and 20 hours per day, from 6:00 AM to 2:00 AM, on weekends. During weekday service hours, trains typically operate approximately every 20 minutes during peak hours and every 30 minutes during non peak hours in each direction. During weekend service, trains typically operate approximately every 60 minutes each direction. Amtrak operates approximately 48 trains in each direction on weekdays and 34 trains in each direction on weekends. Amtrak trains on the Trenton Line operate 22 hours per day, from 4:00 AM to 2:00 AM, on weekdays and 22 hours per day, from 4:00 AM to 2:00 AM, on weekends. Amtrak trains do not stop at Levittown Station.

2. Holiday Service: SEPTA will prohibit service shut downs, and diversions on certain Holidays and Holiday weekends. Holidays include Memorial Day weekend, the Welcome America Celebration one week before the Fourth of July weekend, the Fourth of July (and the Fourth of July weekend, if applicable), and Labor Day weekend. Outages, shutdowns and diversions shall not be permitted during the “Holiday Season” which is defined as the period starting 5:01 am on the Wednesday before Thanksgiving Day until January 2, inclusive.
3. SEPTA trains stopping at Levittown normally operate on Tracks 1 and 4, but may operate on Tracks 2 and 3 during outages or emergencies. Other SEPTA trains and all Amtrak trains may operate on any track.

4. All trains train normally operate on electric power from the catenary system.

5. Outages – As a general guide, outages will be limited from after the last train, which varies depending on the day of week, until about 5:00 AM. The length of this period will be reduced by the amount of time it takes to de-energize and ground affected wires. These general guidelines are subject to modification depending on time of year and Amtrak and SEPTA schedules at the time of construction.

6. SEPTA or Amtrak reserves the right to return any track to service without prior notification at any time and make other adjustments as needed to facilitate operations.

1.08 WORK SEQUENCE AND CONSTRUCTION PHASING

A. The work sequence for the project is as follows:

1. Sequencing constraints are shown on drawings and in the phasing plans and described in the Specifications. Conceptual sequencing plans are included in the drawings but are not intended to dictate contractor’s means and methods. The drawings depict major changes in overall station operations, therefore Phase 1 should be completed prior to Phase 2, and Phase 2 prior to Phase 3. Specific sequencing of work within a phase may be proposed by the contractors, for review by SEPTA’s Project Manager.

B. The actual construction activities interfering with SEPTA and Amtrak operations and passenger movement shall not begin until:

1. The Contractor provides a written plan (site specific work plan) to SEPTA and Amtrak indicating impact to passenger flow and SEPTA/Amtrak operations. Such plan shall include remedial solutions acceptable to SEPTA and Amtrak.

2. The plan is approved in writing by SEPTA and Amtrak. The Contractor shall be responsible for revision and resubmittal of the plan until it is approved by SEPTA and Amtrak.

C. If the plan calls for the contractor to gain access to track or facilities, operational constraints may delay actual occupancy, or require the contractor to give up occupancy early, for a period usually not exceeding one hour.
D. Before starting work on a construction phase, the Contractor may submit a written request to SEPTA to amend or adjust the phasing plan. The criteria detailed on paragraph 1 below must be satisfied in the proposed amendment.

1. Operational Criteria: The station must remain operational during normal Amtrak and SEPTA operating hours and the Contractors’ plans must provide access to station building, platforms, stairs, and underpass or overpass during construction.

2. Review Procedures: All Contractor proposed amendments must be reviewed and approved by both SEPTA and Amtrak prior to starting any related work.

1.09 DAMAGES FOR FAILURE TO RETURN TRACK AND/OR FACILITIES TO SERVICE

A. The Contractor will be responsible for actual damages to SEPTA (as defined in the Special Provisions) resulting from failure to return Trenton Regional Rail and NEC tracks to service following the end of the construction shutdown or causing any unapproved outage or service interruption.

1.10 SEPTA OCCUPANCY AND USE

A. Portions of the Work may be placed in operation by SEPTA in advance of the completion of all Work. Occupancy and/or utilization of parts of the Work by SEPTA will not relieve the Contractor of responsibility for proper integrated completion of all parts of the Work, nor shall it act to relieve the Contractor of any responsibilities under the Contract Documents for warranty of the Work.

1.11 EXISTING CONDITIONS

A. The existing conditions represented in the Contract Drawings are based on the best available information obtained from one or any combination of the following sources: field survey, as-built documents, reference drawings, and/or visual investigation.

B. The contractor is responsible for verifying the conditions presented. If verified conditions are close to those represented on the Contract Drawings, the Contractor shall, in addition to reporting the verification to the Project Manager, proceed with the Work at no additional cost to SEPTA. If conditions are significantly different to those presented on the Contract Drawings, the
Contractor shall, in addition to reporting the verification to the Project Manager, submit a detailed scheme and associated cost for completing the required work for review and comment. The Contractor shall allow 10 days for review and comment.

C. The Contract Documents establish specific criteria and standards of performance. The Contractor shall use its discretion to determine means of compliance and is responsible for coordinating with other Contractors at the site in order to achieve compliance.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION
PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this Contract generally consists of the following:

1. Demolition of the existing station platforms, canopies, stairs and enclosures, and station building.

2. Demolition of existing curbs and sidewalks, portions of existing streets, and other items as required.

3. Furnishing and installation of a new station building.


5. Furnishing, fabricating, and installing new canopies.

6. Construction of a new pedestrian overpass bridge with access stairs and elevators.

7. Construction of new curbs, sidewalks, and street pavement.

8. Water distribution, storm drainage, and sanitary sewer work.

9. Furnishing and installing electric power and communications.

10. Furnishing and installing fire alarm systems.

11. Construction of new stairs and ramps to access building and platforms.

12. Filling in of the existing pedestrian tunnel beneath the tracks.

1.02 RELATED WORK

A. Section 01010: Summary of Work.

B. Section 01041: Project Coordination.

C. Section 15010: Mechanical Requirements.

D. Section 16010: Electrical Requirements.
1.03 ADMINISTRATIVE AND PROCEDURAL SECTIONS

A. Agreement and Exhibit III scheduling requirements.
B. Section 01025: Measurement and Payment.
C. Section 01060: Regulatory Requirements and Safety.
D. Section 01300: Submittals.
E. Section 01400: Quality Requirements
F. Section 01500: Construction Facilities and Temporary Controls.
G. Section 01600: Material and Equipment.
H. Section 01700: Contract Close Out.

1.04 TEMPORARY FACILITIES AND SERVICES

A. Section 01500: Construction Facilities and Temporary Controls.
B. Section 01520: Temporary Construction.
C. Section 01520A: Requirements for Temporary Protection Shields
D. Section 01570: Maintenance and Protection of Vehicles, Pedestrians, and Passengers (MS).

1.05 GENERAL CONTRACTOR (GC)

A. Specific responsibilities of the GC are referenced in:
   1. Section 01050: Field Engineering.
   2. Section 01500: Construction Facilities and Temporary Controls.
   4. Section 01520A: Requirements for Temporary Protection Shields.
B. The Work of the General Contractor includes the civil, architectural, and
structural work of the project as described on the drawings and technical specifications. In addition, the General Contractor is the Coordinating Contractor responsible for certain general obligations and coordination/administration responsibilities described in the Division 1 specifications. The General Construction work includes but is not limited to the following:

1. Demolition of the existing station building, platforms, canopies, stairs, and enclosures.
   a. Prior to demolition, remove existing Levittown Station signage to give to local historical society. Refer to Section 01010 Summary of Work, Article 1.06E for details.

2. Utility work as follows:
   a. Water distribution system including water mains and service lines as indicated.
   b. Sanitary, storm, and combined sewer systems and laterals.

3. General construction work as follows:
   a. All necessary permits, approvals, fees, temporary barricades, barriers, and signage.
   b. Excavation and earthwork.
   c. Construction of the platform and canopy foundations.
   d. Construction of the platforms and canopies.
   e. Construction of the station building foundations.
   f. Furnish and install prefabricated station building.
      1. Furnish and install within the new station building a historic display developed by SEPTA; location of display to be defined by SEPTA.
   g. Install roof over prefabricated station building.
   h. Construction of the stairs and ramps.
   i. Construction of the pedestrian overpass bridge including elevator and stair enclosures.
   j. Furnishing and installing passenger elevators.
k. Construction of new sidewalks, curbs, and pavement structures.

l. Painting of structural steel.

m. Site restoration, including paving and landscaping.

n. Filling of the existing pedestrian tunnel beneath the tracks.

o. Make the necessary electrical connections to maintain the temporary power and lighting necessary for the entire construction project. SEPTA will pay the utility bill for the energy used for lighting and power to maintain station operation. The Contractor is responsible for providing the energy used to support construction activity.

p. Make the final connections to the elevator equipment (by the General Contractor's equipment installer) and equipment in Architectural Specifications requiring electrical service.

4. Field Engineering: conduct a complete survey of the project site and coordinate and provide survey information to other prime contractors at site for proper performance of work.

5. Maintenance and Support of Existing Utilities: Coordinate, maintain, support, protect, and restore the requirements of existing public and private utilities affected by the construction, as specified in Section 01510 – Maintenance, Support, and Restoration of Existing Utility Facilities.

6. Site Access: The Contractor shall provide unimpeded access to the station facilities and platform area and maintain the existing walkways free of obstructions, as per Section 01500 – Construction Facilities and Temporary Controls.

7. General Cleaning, Graffiti Removal, and Pest Control: Perform cleaning, graffiti removal, and pest control in accordance with Section 01500 – Construction Facilities and Temporary Controls. Engage an experienced exterminator to provide monthly treatment until the project closeout to rid project site within the contract limits of rodents, insects, and other pests.

8. Maintenance and Protection of Vehicles, Pedestrians, and Passengers: The Contractor shall prepare working drawings showing proposed traffic control devices and shall apply to the local jurisdictional agency for a permit to work in the right of way. Any proposed changes to the traffic pattern of SEPTA’s passengers shall be approved by SEPTA’s Project Manager. All relevant work will
comply with the Section 01570 – Maintenance and Protection of Vehicles, Pedestrians and Passengers.

9. Project Signs: Install and maintain SEPTA and other project signs as directed by SEPTA Project Manager and as required per the contract. Replace these signs as often as necessary to maintain the signs in “like-new” condition. Refer to Section 01580 – Project Signs.

10. Maintenance: Provide the required maintenance for all equipment and materials installed under this contract in “like-new” condition until date of final payment.

1.06 MECHANICAL CONTRACTOR (MC)

A. This contract includes but is not limited to furnishing and installing the Work as indicated in the Contract Documents for construction of the Levittown Station. The work to be performed by the Mechanical Contractor consists generally of the following:

1. Excavation and backfill required for work of Division 15.

2. Sanitary system including plumbing fixtures, specialties, piping, drains extending beyond the building or facility to a point five feet from the face of the exterior wall.

3. Storm drainage system connection for roof drains.

4. Domestic hot and cold water systems including piping, valves, hangers, insulation, hose bibs, and water heaters.

5. Fire protection system.

6. Heating, ventilating, and air conditioning systems and equipment.

7. Ductwork and piping systems.

8. Testing and balancing of all installed systems.

9. Field painting of damaged factory finishes on equipment.

10. Curbs, hangers, and supports.

11. Electrical appurtenances for electrically operated mechanical equipment.

12. Coordination with General Contractor and Electrical Contractor.
B. Other specific responsibilities of the Mechanical Contractor include but are not limited to:

1. Section 01500: Construction Facilities and Temporary Controls.
2. Section 01520: Temporary Construction.

C. Provide the required maintenance for all equipment and materials installed under this contract in “like-new” condition until date of final payment.

D. Submit all piping, fitting, and equipment installation drawings for SEPTA concurrence prior to the beginning of any work but after such drawings are coordinated with the GC and approved by other subcontractors. If any work is performed prior to obtaining concurrence of SEPTA, the MC will be responsible for removal, installation, damages, and delays to the Project.

E. Any incidental work related to specifications in Divisions 2 through 14.

1.07 ELECTRICAL CONTRACTOR (EC)

A. This contract includes but is not limited to furnishing and installing the Work as indicated in the Contract Documents for construction of the Levittown Station. The work to be performed by the Electrical Contractor consists generally of the following:

1. Excavation and backfill required for work of Division 16.
2. New electrical service and sub-systems.
3. Electrical power to mechanical equipment.
4. Electrical power to elevators.
5. Emergency power system.
6. Lighting systems and fire alarm systems communications.
7. Coordination with General Contractor and Mechanical Contractor.

B. Other specific responsibilities of the Electrical Contractor include but are not limited to:

1. Section 01500: Temporary Utilities.
2. Section 01520: Temporary Construction.

C. Provide the required maintenance for all equipment and materials installed under this contract in “like-new” condition until date of final payment.
under this contract in “like-new” condition until date of final payment.

D. Submit conduit fitting and equipment installation drawings for SEPTA’s concurrence prior to the beginning of any work but after such drawings are coordinated with, received, and approved by the other contractors. If any work is performed prior to obtaining concurrence of SEPTA, the Contractor will be responsible for removal, installation, and damages and delays to the Project.

E. Provide the required maintenance for all equipment and materials installed under this contract in “like-new” condition until date of final payment.

F. The Electrical Contractor shall provide personnel and equipment to assist in the proper coordination of service interruptions as specified in Section 01510 – Maintenance, Support, and Restoration of Existing Utility Facilities.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION
SECTION 01025 - MEASUREMENT AND PAYMENTS

PART 1   GENERAL

1.01   DESCRIPTION

A. This section specifies general requirements for measurement of quantities and schedule of values required to process payment applications according to the provisions set forth in the Agreement.

B. Provide a detailed breakdown of the Contract Sum showing values allocated to each of the various parts of the Work, as specified herein, and as required by other provisions of the Contract Documents.

1.02   RELATED WORK:

A. Exhibit III of the Agreement

1.03   MEASUREMENT OF QUANTITIES

A. The Work performed under the Contract will not be measured, except to establish percentage of completion for each value line payment item.

1.04   SCOPE OF PAYMENT

A. Payment for work performed under the Contract will be paid in accordance with the agreement, for the:

1. Bucks County Intermodal Station Improvements, Levittown Station, R7 Trenton Regional Rail Line.

2. Complete in place and in conformance with the Contract Documents.

1.05   QUALITY ASSURANCE

A. All requirements of values in accordance with the requirements of Section 01400.

1.06   SCHEDULE OF PAYMENTS

A. Submit a schedule of values in accordance with the requirements specified in the Agreement.
END OF SECTION
SECTION 01041 - PROJECT COORDINATION

PART 1 GENERAL

1.01 DESCRIPTION

A. This specification covers project coordination responsibilities of each separate Contractor for this Project.

1. Throughout the progress of the Work, perform coordination responsibilities as defined herein and as noted in related sections of the Specification.

2. Coordinate the Work of its own employees and subcontractor(s).

3. Coordinate the work with the Work of other Contractor(s).

4. Expedite coordination process to assure compliance with the project schedule.

1.02 RELATED WORK:

A. Agreement and Exhibit III

B. Division 1:

1. Section 01010 - Summary of Work

2. Section 01011 - Summary of Project

3. Section 01045 - Cutting and Patching

4. Section 01060 - Regulatory Requirements and Safety

5. Section 01064A – Railroad Safety Requirements for Work on Amtrak Property.

6. Section 01400 - Quality Requirements

C. Technical Section

1. Section 15010 Basic Mechanical Requirements

2. Section 16010 Basic Electrical Requirements
1.03 COORDINATION AND MEETINGS

A. The Coordinating Contractor, as designated under Exhibit III of the Agreement and Section 01011, is hereby assigned the full responsibility to ensure that the work to be performed by other Separate Contractors under this Project is coordinated in a manner to eliminate any negative impact to the schedule and any installation sequencing conflicts.

B. The Coordinating Contractor shall conduct regular construction coordination meetings and prepare written memoranda regarding coordination activities. These memoranda shall include such items as required notices, resolution of conflicting activities reports and attendance at meetings. The coordinating contractor shall distribute these memoranda to each Contractor performing Work at the site and provide copies to SEPTA's Project Manager within 10 days of the meeting date. In addition to other responsibilities noted elsewhere in this specification, the Coordinating Contractor shall:

1. Establish administrative procedures and distribute these procedures to each Contractor within 30 days from the date of the notice to proceed.

2. Arrange and conduct pre-installation meetings affecting all Contractors at site, as may be required for quality control, access, and sequencing.

3. Resolve schedule and installation conflicts among Separate Contractors (see Section 1.04 below).

4. Establish control for the use of site, maintenance of traffic, and Quality Control (QC) monitoring during construction.

5. Monitor and enforce general discipline among the contractors at site concerning safety, site protection, and cleaning. The Coordinating Contractor is responsible for coordinating and monitoring activities among the Separate Contractors to secure, protect, and waterproof unfinished and exposed work.

6. Inform SEPTA’s PM of the time and place of each construction coordination and pre-installation meeting. SEPTA may elect to have a PM’s representative present.
1.04 COORDINATION MEETINGS AMONG CONTRACTORS

A. All Contractors are alerted to the importance of coordination and cooperation among themselves. It is essential to the expeditious and accurate completion of this project that the Contractors meet at an early stage in the work for the purpose of allocating their construction space requirements.

B. In such areas where their installations are in close proximity, or are likely to be in conflict or interfere with one another, it is mandatory that the Coordinating Contractor set up regular meetings as shop drawings are developed. The meetings shall be for the purpose of modifying work schedules to adjust for conflicts and to arrive at an orderly sequence of operations agreeable to all Contractors so delays may be avoided. The meetings are also intended to determine the need to prepare coordination drawings for the use and guidance of each Contractor.

C. The meetings will be arranged through and managed by, the Coordinating Contractor, and shall be separate from, and in addition to, the regular job progress meetings. If it is desired that the Architect/Engineer be present at such meetings, a request to this effect should be directed to SEPTA’s Project Manager with at least 3 days’ notice. Unless specifically excused by the Coordinating Contractor, attendance by all of the separate contractors and their subcontractors/vendors (as needed) is mandatory. The Contractors’ representatives at the meetings shall have the competence and authority to make any necessary decisions and their statements shall commit the Contractors to the agreed procedures, sequence of operations and time schedules.

1.05 FIELD COORDINATION AMONG CONTRACTORS

A. In deciding construction conflicts in the field, the following is the order of priority for construction space (Note – Finished ceiling heights to be maintained as indicated on the contract documents):

1st - Ductwork
2nd - Fire Protection Piping
3rd - Other Piping
4th - Electrical Conduit

B. If a structure and/or enclosure is to be constructed over equipment, the Contractor shall deliver, set and protect equipment and materials before erection of confining enclosures. All equipment and materials so confined shall be inspected and tested prior to delivery. Should equipment or materials fail to meet the requirements of the specifications, the Contractor who did not provide the specified testing shall replace equipment or materials and pay all
costs, including costs for modifications of completed areas that are required to provide passage.

C. Failure to be represented at any of these meetings shall subject the absent Contractor to liability for any and all damages, delays, costs of alterations, etc., which result from the fact that its representative was not present to coordinate its work with the other contractors.

D. If a conflict develops as a result of coordination failure of any Contractor, SEPTA will determine which Work shall be relocated or replaced, regardless of which was installed first, and the cost shall be the sole responsibility of the Contractor(s) who failed to properly coordinate.

1.06 COORDINATION DRAWINGS

A. Coordination drawings must be prepared using field verified dimensions including clear dimensions, elevations, and locations relative to the building lines and/or baselines, and other adjacent structures. The Coordinating Contractor shall prepare the coordination drawings (in 1/8” – 1’0” scale) of equipment, piping, ductwork, etc. to be installed at site, and submit drawings to all other Contractors for review, comments, coordination, and approval before any contractor begins work.

B. The Coordinating Contractor must insure that coordination drawings and related shop drawings are submitted for SEPTA’s review after the drawings have been reviewed and approved by the other Separate Contractors. Coordinate work with architectural and structural drawings for exact space conditions; where not readily discernible, request information from the Architect/Engineer before proceeding.

C. Where procedures have been agreed upon and coordination drawings accepted by all Contractors concerned, the coordination drawing(s) must be transmitted to the SEPTA PM as a formal shop drawing, and it shall become binding upon all Contractors to follow the coordination drawings and procedures. A responsible supervisor from the staff of each Contractor shall supervise the work of his contract

1.07 PRE-INSTALLATION MEETINGS

A. The Coordinating Contractor is responsible to coordinate the Work of all separate Contractors at the site to eliminate any scheduling conflicts in the installation of each unit of work. The SEPTA PM will be invited to all pre-installation meetings.

B. Each Contractor shall schedule and conduct pre-installation meetings with its own subcontractors, suppliers, manufacturers, fabricators, and other affected
trades for each unit of work affecting the quality or proper sequencing of Work, prior to the construction coordination meeting with the Coordinating Contractor.

C. Each contractor will provide SEPTA with 3 days’ notice for all pre-installation meetings so that SEPTA may participate if it chooses.

D. The pre-installation meetings must at least include following topics of discussions:

1. Requirements of the Contract Documents and the approved shop drawings, product data and quality (see 1.04 above) control samples.

2. Coordination with other contractors. Possible installation conflicts and resolutions with existing and new work not resolved during the construction coordination meetings.

3. Delivery Schedule and Site Access

4. Weather limitation

5. Space and access limitations

6. Regulatory requirements

7. Safety during installation

1.08 COORDINATION WITH OTHER CONTRACTORS AT SITE

A. In addition to multiple prime contractors working on a project, there may be other active contracts (refer to Section 01010, Article 1.08) on the project site engaged in activities not directly associated with the Work of this project. The Coordinating Contractor (CC) will consider these other contracts when developing the project schedule. SEPTA's PM will be responsible for the day-to-day coordination of the Work of the other contractors as required.

B. SEPTA will not consider any time extension or monetary compensation for delays or damages as a result of the Coordinating Contractor’s failure to adequately document or communicate the other Contractor’s activities in the integrated schedule or the separate Contractor(s)’ failure to act on the information furnished by the CC. SEPTA may only consider a time extension to the Contract if it is documented by the CC, to the satisfaction of SEPTA that the Contractor has responsibly complied with these coordination requirements.
C. If the damage to the project's Work occurs as a result of the other contractor's activities, the Contractor shall promptly settle the matter with the other Contractor to avoid impacting the schedule and warranty provisions of this Contract.

END OF SECTION
SECTION 01045 - CUTTING AND PATCHING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: This section covers general requirements pertaining to cutting, fitting, and patching of the work required to:

1. Make the installation fit properly in an existing or new structure;

2. Uncover work to inspect hidden conditions and then patch.

3. Remove and replace non-conforming or otherwise defective work.

4. Repair holes and cracks caused by removal of existing or new but misplaced accessories and equipment.

5. Coordinate work with other contractors.

B. Responsibilities: Each separate Contractor shall be responsible for performing its own cutting, fitting, and patching work except where otherwise specifically noted in the Contract Documents.

1.02 RELATED WORK

A. Section: 01010: Summary of Work

B. Section: 01011: Summary of Project

C. Section: 01041: Project Coordination

D. Section: 01060: Regulatory Requirements and Safety

E. Section: 01300: Submittals

F. Section: 01400: Quality Requirements

G. Section: 01600: Materials and Equipment
1.03 SUBMITTALS

A. Prior to cutting or modifying any element, submit written a request to the SEPTA Project Manager for permission to proceed with any demolition, cutting or patching.

B. The SEPTA PM may require the contractor to submit a detailed plan, at least 10 business days in advance of the desired date of the work, with any or all of the following information:

1. Explanation of why this work is needed.
2. Extent of work and how adjacent work will be protected and blended in at the work’s conclusion.
3. Modifications to existing structural components including stamped calculations and drawings by a licensed engineer.
4. Products and methods to be used in the work.
5. Schedule of when the work is to be done.
6. Utilities (both SEPTA and non-SEPTA) affected by the work.
7. At historical locations, specific procedures which will mitigate the impact of the cutting and patching on the historical integrity of the structure.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Provide a plan for the inspecting/testing of all modified structural components to ensure structural integrity is maintained. This plan shall be stamped by a structural engineer and submitted to the SEPTA PM.

C. The SEPTA PM reserves the right to require an approved mock-up for any cutting and patching work prior to execution of the entire work.

1.05 RESTRICTIONS

A. Structural elements shall not be cut or patched in a manner that would reduce the load carrying capacity or load deflection ratio. All processes which
affect structural members must be sealed by a licensed engineer and submitted to SEPTA for review before work begins.

B. Operating elements or safety related components shall not be cut or patched in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance or decreased operational life or safety.

C. Construction exposed on the exterior or in occupied spaces shall not be cut or patched in a manner that would, in the opinion of the SEPTA Project Manager, reduce the building elements’ aesthetic qualities, or result in visual evidence of cutting and patching. The responsible Contractor shall remove and replace work cut and patched in a manner deemed to be visually unsatisfactory by the SEPTA Project Manager.

D. Dispose of all waste in a legal manner following all local codes and regulations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Except as otherwise indicated in the contract documents or approved by the SEPTA Project Manager, provide materials for cutting and patching which will result in equal or better work than work being cut-and-patched, in terms of performance characteristics and including visual effect where applicable.

B. Use materials identical with original materials where feasible and satisfactory results can be produced subject to review by the SEPTA PM. If original materials are unavailable, use materials which match appearance and match or exceed performance of the original material as interpreted by the SEPTA PM.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, patching, and backfilling.

B. Provide temporary support before uncovering any hidden conditions. See 3.02 below.

C. After uncovering existing conditions, inspect conditions affecting installation of new work, including the suitability of all substrates to receive new material.
3.02 HAZARDOUS AND DANGEROUS CONDITIONS

A. If, during the preliminary inspection and/or the cutting and patching procedure, material of a suspicious nature is discovered, the contractor shall stop work in the vicinity immediately, abandon, isolate and mark the area, erect signs saying Do Not Enter, and alert the SEPTA PM immediately.

B. If, during the preliminary inspection and/or the cutting and patching procedure, the safety of the structure appears to be endangered or there appears to be movement in structural elements, the contractor shall stop work immediately, install bracing, mark the area, erect signs saying Do Not Enter, and alert the SEPTA PM immediately.

3.03 DISCREPANCIES

A. If uncovered conditions are inconsistent with the construction documents, immediately notify the SEPTA Project Manager and secure needed direction.

B. Do not proceed until undocumented conditions are resolved and the SEPTA PM gives direction.

3.04 TEMPORARY SUPPORT AND PROTECTION

A. Provide adequate temporary support to prevent instability of Work to be cut. Do not endanger adjacent Work.

B. Provide adequate protection of the work, including adjacent areas during cutting and patching, to prevent damage and to protect from adverse weather exposure.

C. Where services and utilities are to be affected by cutting and patching work, attempt to bypass to avoid interruption or obtain prior approval for this work.

3.05 PERFORMANCE

A. Perform required excavation and backfilling in accordance with the pertinent sections of the Specification and in conformance with all safety regulations and requirements.

B. Cut work in a matter which avoids damage to work to be retained and adjoining work. Where physical cutting is required, cut Work with sawing and grinding tools maintaining a neat straight finished edge. Core drill openings through concrete and masonry work. Cut from exposed finishes through to unexposed material.
C. Obtain prior approval for all equipment to be used and all demolition procedures. Do not cut with hammer and chipping tools. Use water and adequate ventilation to control dust.

d. Do not cut mechanical or electrical equipment or conduit without determining status of equipment with certainty and consulting with the appropriate contractor. Never assume equipment or conduit is abandoned without establishing its status. Cap or seal piping, ductwork and conduit to prevent moisture from entering.

E. Patch seams to be durable and invisible to the satisfaction of the SEPTA PM. Restore exposed finished or patched areas in a manner to eliminate evidence of patching.

F. Do not cut and patch operational elements or safety related components in a manner that would result in a reduction of their capacity to perform in the manner intended, or that would result in increased maintenance, or decreased operational life or decreased safety.

G. Where new or enlarged doorways or openings are shown in existing construction, take the necessary precaution to support the walls above the openings and install new steel lintels above the openings. Where the wall finish is plaster or CMU, reinforced precast block lintels may be used where approved by the SEPTA Project Manager. New wall materials shall be toothed into existing wall materials. New metal frames shall be anchored and grouted identically to what is required for all new work.

H. If existing utilities, pipes, and/or conduits must be relocated by any contractor; the affected contractor shall install by-pass services of quality equal to the existing system prior to beginning the work subject to the approval of the SEPTA PM.

I. When painting patched areas, continue painted area to a visual barrier such as an expansion joint, edge of material, corner or other joint. Obtain approval for paint color matches on a mock-up which, if approved by the SEPTA PM, may become part of the work.

J. At exterior locations, test all patches to determine if they create a water tight condition.

3.06 CLEANING

A. Before an area is turned back to SEPTA for use, thoroughly clean areas and spaces where work has been performed or used as access to work.

B. Thoroughly clean piping, conduit, and similar fixtures before painting or other finishing is applied.
C. Restore items suffering incidental damage, such as pipe covering and miscellaneous finishes, to their original condition.

END OF SECTION
PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: This Section of the Specifications covers field engineering services as necessary to correctly complete the Work including, but not limited to:

1. Establishing and maintaining lines, levels, and other survey controls as dictated by the specific project parameters.

2. Structural design of sheeting, shoring, formwork, temporary supports/falsework, and other similar items provided by the Contractor as needed for the execution of the work.

3. Structural design of the overpass for temporary conditions during shipping, handling, and erection which are based on the Contractor’s means and methods for installing the overpass.

B. Responsibilities: Each Separate Contractor is responsible to perform its own field engineering/surveying work.

1.02 RELATED WORK

A. Section 01300: Submittals

B. Section 01520A: Requirements for Temporary Protection Shields

C. Section 01700: Contract Closeout

D. Section 01720: Project As-Built Documentation

1.03 SUBMITTALS

A. Comply with pertinent provisions of Section 01300.

B. Contractor(s) in all cases shall submit:

1. Documentation demonstrating qualifications of persons proposed to be engaged for field engineering/survey services.
2. Documentation detailing the methods that the Contractor proposes to use to achieve and verify required survey accuracy.

3. All survey-related submittals shall be accompanied by a certification, signed by the Contractor's retained field engineer, stating that elevations and locations of improvements are in conformance or nonconformance with the requirements of the Contract Documents.

4. Provide shop drawings and design calculations sealed by an engineer licensed in the Commonwealth of Pennsylvania for all falsework and temporary or interim supports including sheeting, shoring, excavation supports, cofferdams, concrete forming systems, and steel erection devices among others.

5. Shop drawings and design calculations for the overpass framing for load conditions that will exist during shipping, handling, and erection of the overpass structure.

6. Amtrak-required work plans and submittals as indicated in Section 01141A Safety and Protection of Railroad Traffic and Property.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled professionals and technicians who are thoroughly trained and experienced in the necessary areas and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this section.

B. A Professional Land Surveyor (PLS) Licensed to Practice in the Commonwealth of Pennsylvania shall perform the survey work for the Contractor. The PLS shall be on the Work site whenever survey activities are taking place.

C. Temporary support/excavation support shop drawings and calculations shall be prepared, signed, and sealed by a Professional Engineer licensed in the Commonwealth of Pennsylvania.

D. Overpass shipping, handling, and erection design calculations and shop drawings shall be prepared, signed, and sealed by a Professional Engineer licensed in the Commonwealth of Pennsylvania.
1.05 ENGINEERING PROCEDURES

A. The contractor’s engineer shall design all construction related structures to the satisfaction of SEPTA and Amtrak. All designs must be submitted in accordance with the requirements of Specification Section 01300 Submittals, paragraph 3.03 to allow sufficient time for review. SEPTA and Amtrak will not be responsible for delays caused by resubmittals if required.

1.06 SURVEYING PROCEDURES

A. In addition to procedures executed by the Contractor and his subcontractors for proper performance of the Work, the Contractor shall:

1. Locate and protect control points before starting work on the site.

2. Preserve permanent reference points during progress of the Work.

3. Not change or relocate reference points or items of the Work without specific approval from SEPTA.

4. Promptly advise SEPTA when a reference point is lost or destroyed or requires relocation because of other changes in the Work.

   a. Upon direction of SEPTA, require the Contractor’s surveyor to replace reference stakes or markers.

   b. Locate such replacements according to the original survey control.

B. The General Contractor shall engage a Professional Land Surveyor (PLS) to:

1. Log elevation of critical points of the project such as Amtrak track T/R elevations.

2. Log elevations every 50 feet.

3. Stakeout inbound and outbound construction baselines.

4. Stakeout the Project Property and layout and install monuments.

C. Before proceeding with the layout of actual work, the General Contractor, Mechanical, and Electrical Contractor shall verify the layout information shown on the drawings, in relation to the property survey and existing benchmarks. As the work proceeds, the surveyor shall check every major element for line, level and plumb. A surveyor’s log or record book of such checks shall be maintained current at all times. Make this log or record book
available for SEPTA or SEPTA's Architect and/or Engineer's reference. The
surveyor shall record deviations from the required lines and levels, and shall,
upon detection, promptly advise SEPTA of deviations exceeding indicated or
recognized tolerances. The Contractor shall update final survey information
on as-built drawings.

D. The General Contractor shall be responsible for the stakeout of all property
lines and corners required to establish the location of fences and other items
of work, of which location is referenced thereto.

E. The General Contractor shall assume full responsibility for dimensions and
elevations taken from benchmarks and baselines and for the setting of lines
and grades.

F. The General Contractor shall provide SEPTA with any assistance required
for checking lines, grades, and measurements as may be requested by
SEPTA.

1.06 PROJECT SURVEY RECORDS

A. On completion of any major structural element of the Work such as
foundations, abutments, piers or other significant site improvement, the
Contractor shall prepare and submit a certified survey illustrating dimensions,
locations, angles, and elevations of the final construction and site work.

B. The Contractor shall preserve all field books and stakeout data until Final
Acceptance of the Work at which time they will be signed and sealed by the
licensed Surveyor (PLS) and turned over to SEPTA. The Contractor shall
comply with any requests by SEPTA to review field books and stakeout data
at any time during the course of Work. Submit field books and stakeout data
to SEPTA as part of Project Closeout. The field books and stakeout data will
become the property of SEPTA.

1.07 SURVEY CREWS

A. The Contractor shall employ a survey crew, consisting a minimum of one
party chief and two rodmen. The minimum required crew shall be onsite at all
times during construction phases where their work is required, to perform all
survey related tasks as necessary to properly execute the Work in
accordance with these specifications and the Contract Drawings.

B. In addition, the members of the survey crew must be located in such proximity
to the Work site that mobilization is possible within four hours of notification
by SEPTA when an unanticipated need for their services occurs.
C. The survey crew should be available on site at all times when driving sheeting occurs.

END OF SECTION
SECTION 01060 - REGULATORY REQUIREMENTS AND SAFETY

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies the regulatory and safety requirements for prosecution of the Work and supplements the requirements specified in the Agreement. The Contractor is required to assure that all employees, subcontractors, and suppliers/vendors, while on the Work site and/or in the conduct of the Contract, comply with the provisions of this Section.

B. The Contractor shall take every precaution necessary to assure the safe access and egress of all SEPTA patrons and employees, the safe and continuous operation of all SEPTA vehicles, ensure the appropriate protection of the environment, as well as the safety and general welfare of the public at large.

1.02 RELATED WORK

A. Agreement

B. Section 01041: Project Coordination

C. Section 01064A: Railroad Safety Requirements for Work on Amtrak Property

D. Section 01100: Special Project Procedures

E. Section 01141A: Safety and Protection of Railroad Traffic and Property

F. Section 01142A: Amtrak Review of Bridge Erection, Demolition, and Other Crane/Hoisting Operations over Railroad Right-of-Way

G. Section 01400: Quality Requirements

H. Section 01500: Construction Facilities and Temporary Controls

I. Section 01520A: Amtrak Temporary Protective Shields

1.03 SUBMITTALS

A. The Contractor shall furnish a copy of the Contractor’s employee safety program to the Project Manager within 30 days from receipt of the Notice to Proceed.
B. The General Contractor shall submit roof plan and fire alarm plan to FM Global, c/o Craig Kissel, 64 Twin Brooks Drive, Willow Grove, PA 19090 for review prior to starting the work on these components. FM Global review typically requires two (2) weeks for review and approval. Submit two (2) full-size complete sets to FM Global.

1.04 QUALITY ASSURANCE

A. The Contractor shall daily monitor and document the compliance and performance of the requirements set forth in this Section consistent with appropriate SEPTA Work rules and local, Commonwealth of Pennsylvania, and federal rules and regulations. The Contractor shall document the Contractor's compliance with all of the above-referenced codes.

B. The Contractor’s employee safety program, as a minimum, shall include but not be limited to the following:

1. Construction Orientation
2. Occupational Safety and Health Administration (OSHA) Inspection and Compliance
3. General and Site-Specific Safety
4. Workmen’s Compensation Reporting
5. Fall Protection/Personal Protective Equipment
6. Confined Space
7. Hazardous Materials
8. Trenching and Excavation
9. Cranes
10. Electrical Protection
11. Drug and Alcohol
12. Public and Passenger Protection

C. The Contractor shall provide a qualified safety officer who shall be responsible for all safety-related activities until the completion of the Work. The safety officer shall report all on-the-job injuries at once to the Project Manager and submit all paperwork pertaining to such injuries, as required.
D. The Contractor's superintendent or safety officer shall as a minimum hold weekly (tool box) safety meetings with all of the Contractor’s personnel. Subjects, time, and location may be set at the Contractor's convenience. SEPTA requires at least three (3) days prior notice of location and time of each meeting, and an agenda shall be submitted to the Project Manager. Attendance sheet, signed by each person in attendance, and minutes of each safety meeting shall be provided to the Project Manager at each regularly-scheduled project coordination meeting.

E. The Contractor is required, by Agreement, to maintain an alcohol and drug free environment. The Contractor shall describe in their employee safety program on how this contract stipulation is to be accomplished and maintained. Please note that SEPTA reserves the right to restrict access to it’s property, because of the inherent safety hazard to its employees and general public. Any person shall be removed and barred from SEPTA property if in the opinion of SEPTA’s Project Manager, and/or other appropriate SEPTA representative that person constitutes a safety risk.

1.05 GENERAL SAFETY REQUIREMENTS

A. All work shall be performed in accordance with rules, regulations, procedures, and safe practices of SEPTA, Amtrak, Federal Railroad Administration (FRA), Commonwealth of Pennsylvania, OSHA, and all other governmental agencies having jurisdiction over the Work. The following safety rules are highlighted from the aforementioned documents and are considered especially applicable to all of the contractor's employees in regard to conduct while on SEPTA property.

1. Each Prime Contractor must obtain approval to enter Amtrak property as noted in the Division 1 specifications. Each employee entering Amtrak property within 25 feet of the tracks must attend Amtrak Safety Training as required in Specification 01141A.

2. Contractor’s employees shall wear hard hats, suitable work shoes or boots (as required), vests and full body cover clothing, at all times, and safety glasses if required.

   a. Hard hats shall be ANSI-Z89.1, Class E

   b. Work shoes shall have non-slip soles. Permanent metal plates or cleats on the sole or heel of shoes are prohibited. Shoelaces are to be kept short so they do not pose a tripping hazard. Athletic shoes, sandals, open-toed shoes, moccasins, and/or shoes with heels higher than 1” are not permitted.

   c. Contractor personnel shall wear eye protection for all structural track and specialized work activities and any other protective
equipment in accordance with the applicable OSHA regulations. Eye protection shall be safety glasses with rigid side shields that comply with ANSI Z-87.1. Prescription eyewear shall also meet the same requirements as described above, or the individual shall wear equivalent eye protection over their prescription glasses or contact lenses.

d. The safety vest shall be ANSI 107, Class 2 high-visibility with a yellow-green background and 2-inch retro-reflective striping for work on SEPTA owned track. Amtrak track requires the use of an orange vest subject to approval by Amtrak.

e. The Contractor's personnel shall wear long pants (without cuffs) and, at a minimum, short-sleeve shirts, not cut-off shirts.

B. The Contractor shall take all necessary precautions and provide protective measures to prevent injury to the public and damage to property of others. Before commencing operations, the Contractor shall furnish and erect construction fencing or barricades and signage, as specified, for the safeguarding of the public against accident or damage resulting from the Contractor's operations, and as required to prevent unauthorized access to the Work and to the storage areas. The Contractor shall maintain the protective measures and/or construction fencing until removal.

The Contractor shall dismantle and remove construction fencing when required or when directed by the Project Manager.

1.06 EMERGENCY PROCEDURES

A. The Contractor shall set up emergency procedures and prepare written guidelines discussing such procedures for the following categories:

1. Fire

2. Injury to employees

3. Injury to general public

4. Property damage, including property of utilities, i.e., gas, water, sewage, electrical, telephone, or pedestrian and vehicle routes.

5. Hazardous/toxic material spill discharges.

6. Site evacuation.
B. Copies of all guidelines for emergency procedures shall be written and posted prior to the initiation of actual construction. Posting shall include emergency telephone numbers and directions to and from the nearest hospital. The Contractor shall have standing arrangements for the transportation and hospital treatment of any employees who may be injured or who may become ill. These guidelines shall be included in the Contractor's written safety program and shall be submitted to SEPTA.

C. The Contractor shall provide and fully equip a first aid station at the site, for first-aid service to any that may be injured in the progress of the Work.

D. SEPTA operational emergencies will be handled by the senior SEPTA Operations personnel present. This individual “The Incident Commander” is responsible for summoning the number of persons required by the situation and assignment of all recommended procedures.

1.07 PROTECTION OF AMTRAK AND SEPTA FACILITIES

A. The Contractor shall be cognizant of and bound by Amtrak's safety rules and regulations specified herein and conduct operations in strict accordance with same.

B. Amtrak shall be the sole judge of protection necessary for the safe operation of its facilities.

C. Amtrak's Facilities and/or Structures shall not be utilized by the Contractor for temporary scaffolding and/or support for the construction effort. A Contractor may however, request Amtrak's consideration for such action. The Contractor shall provide a detailed plan to utilize Amtrak's Facilities and/or Structures. The plans will be submitted to SEPTA PM for Amtrak review and approval prior to the initiation of any work. Amtrak also reserves the right to have the drawings and supporting calculations sealed by a Professional Engineer registered in the Commonwealth of Pennsylvania of deemed appropriate.

1.08 STORAGE AND HANDLING OF MATERIALS

A. The Contractor shall store equipment and materials at the job site in accordance with instructions of the Project Manager and in conformance with applicable regulatory provisions. The Contractor shall not store unnecessary items at the job site. Flammable materials shall not be stored in confined spaces, or other areas such as tunnels, underground rooms and building basements. Flammable materials shall be stored in accordance with
applicable NFPA 30 guidelines. The Contractor shall enforce the instructions of the Project Manager regarding such items as fires and smoking.

B. The Contractor shall take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons.

C. Where it is permitted to store materials on streets, the Contractor shall place such materials in a secured place in accordance with local jurisdictions so as to cause minimum obstruction to traffic and the public safety. The Contractor shall not place materials within 15 feet of fire hydrants nor obstruct drainage gutters or inlets. The Contractor shall obtain and pay for all required permits relative to storage of materials.

D. The Contractor shall submit for review by the Project Manager, sketches defining the operations of all cranes used in support of construction during periods of train operations. The Contractor shall submit, at the Project Manager's request, similar information for cranes or other equipment in use and capable of encroachment.

1. These sketches shall include planned locations and movements of the equipment, calculations demonstrating the adequacy of the capacity of the crane for the loads, the interface between the footprint of the equipment the movement of the boom and loads relative to the existing structure and surrounding buildings, the support grillages and the protection of existing utilities and facilities, and any other pertinent details required by the Project Manager.

2. The following data shall be required for all hoisting operations adjacent to active Amtrak operations and facilities and shall be prepared by and sealed by a Professional Engineer licensed in Pennsylvania.

a. Plans and sections showing locations of cranes, horizontally and vertically, operating radii, with delivery of disposal locations shown. The location of the SEPTA Right of Way and all active facilities shall also be shown.

b. Crane rating sheets showing cranes to be adequate for 150% of the actual weight being lifted. A complete set of crane charts, including crane, counterweight, and boom nomenclature is to be submitted.

c. A location plan showing all obstructions such as wires, poles, adjacent structures, etc., and that the proposed lifts are clear of these obstructions.

d. A data sheet shall be prepared listing the type, size, and arrangements of slings, shackles, or other connecting equipment, all to be designed
for 150% of the actual weight being lifted. Copies of a catalog or information sheets for specialized equipment shall be included.

e. A complete procedure is to be included, indicating the location and order of lifts and any repositioning or re-hitching of the crane or cranes.

f. Temporary support of any components or intermediate stages is to be shown and detailed.

g. A time schedule of the various stages must be shown as well as a schedule for the entire lifting procedure.

E. Materials Handling:

1. Reinforcing steel shall not be used as a lifting ("pick") point on any load or as a guy line anchor.

2. All scrap material of any kind, type, or nature shall be placed daily into designated confined areas or containers specifically supplied for this purpose. Containers shall be removed from the job site when full.

3. All loose material on platforms or other exposed locations shall be removed or secured at the end of each day to prevent dislodgment by train movement, wind, vandalism or other causes.

4. The Contractor shall assure that all chemicals, paints, solvents, and cleaners are maintained per OSHA's hazard standards. Discarded chemicals shall be disposed of in accordance with Pennsylvania D.E.P. requirements. Copies of all Material Safety Data Sheets (MSDS), OSHA Form 20, and the Product Use sheets shall be sent to SEPTA's Project Manager. All training shall be done in accordance with OSHA's Hazard Communication Standard.

1.09 SNOW REMOVAL

A. The Contractor shall remove all snow and ice within the project site as required for the proper protection and prosecution of the Work. The Contractor shall at all times provide and maintain adequate protection against weather so as to preserve all Work, materials, equipment, apparatus, and fixtures free from damage.

B. The Contractor shall not use sodium chloride on any facilities adjacent to SEPTA electric rail lines where the possibility exists that melting mixture may leach onto the Railroad Right of Way.
1.10 WELDING, CUTTING, AND OTHER HOT WORK

A. Gas or electric cutting, burning, or welding shall be done in accordance with the guidelines of NFPA 51 B, the International Fire Code or the provisions below, whichever is more restrictive.

4. If hot work is to be executed at a job site, the prime contractor’s safety officer must have a copy of the current version of NFPA 51B at the job site.

5. The prime contractor’s safety officer shall act as a Permit Authorizing Individual (PAI) and complete the checklist to fulfill the requirements of by 51 B for all torch work. The contractor shall obtain the current copy of SEPTA’s “Hot Work/Source of Ignition” checklist for this purpose.

3. The SEPTA PM shall be notified at least 48 hours in advance of any hot work on site. A copy of each checklist completed for that period shall be delivered to the SEPTA PM at the next job progress meeting.

4. Spark shields and a fire watch must be posted when executing hot work and for a period of at least four hours after all activity has been completed but the SEPTA PM reserves the right to extend the duration of the fire watch in special circumstances. A supply of water and an approved fire extinguisher shall be readily available to the location where the work was done.

5. All oxygen/acetylene bottles must be removed and stored outside of all tunnels, underground stations and other confined spaces at the end of the workday. While in use in a tunnel, underground station or other confined space, they shall be attended at all times. At no times when not in use shall oxygen and acetylene bottles be stored together.

1.11 UTILITIES

A. As per 73 P.S., § 176, et seq., the Contractor is required to notify utilities prior to all excavations. The Contractor shall be held responsible for any damage done to any utility in the prosecution of the Work. The Contractor shall exercise any precautions necessary to prevent damage in working underneath or adjacent to any underground structure. If it becomes necessary for a utility company, through emergency procedures or because of unforeseen conditions, to repair, reconstruct, relay, or relocate utilities within the contract area, after work has commenced by the Contractor, then the said utility company and the Contractor shall make suitable arrangements to overcome such interference. No compensation shall be allowed the Contractor for the disruption to his work. A no-cost time extension may be
granted in accordance with the Contract to the Contractor by SEPTA for the delay that has occurred.

B. All of the above shall be accomplished at no extra cost or charge to SEPTA.

1.12 ENVIRONMENTAL PROTECTION

A. Environmental protection considerations consist of, but are not limited to, the following factors:

1. Natural resources, including air, water, and land.

2. Solid waste disposal.


4. Control of toxic substances, hazardous materials, and radiation.

5. The presence of chemical, physical, and biological elements and agents that adversely affect and alter ecological balances.

6. Degradation of the aesthetic use of the environment.

7. Historical, archaeological, and cultural resources.

B. General Requirements:

1. The Contractor shall provide and maintain environmental protection as defined herein.

2. The Contractor’s operation shall comply with all applicable Federal, Commonwealth and Local laws, ordinances, and regulations pertaining to environmental protection.

3. Compliance of subcontractors with the provisions of this and various other sections of these Specifications shall be the responsibility of the Contractor.

4. The Contractor shall not use equipment from which factory-installed antipollution and noise control devices have been removed or rendered ineffective through lack of proper maintenance.

5. The Contractor shall provide adequate pollution controls for painting and surface preparation in compliance with the State Department of Environmental Resources Regulations.
6. All newly installed materials shall be asbestos free.

C. Protection of Natural Resources:

1. General
   a. It is intended that the natural resources within the project boundaries and outside the limits of permanent Work performed shall be preserved in their existing condition or be restored to an equivalent of the existing condition, as approved by the Project Manager upon completion of the Work. The Contractor shall confine its on-site construction activities to areas defined by the Contract Drawings and Specifications or directed by the Project Manager.

2. Protection of Project Site and Existing Roadways:
   a. Debris or rubbish of any kind shall not be dumped onto the site or roadways. This shall include paint splatters and spillage during painting operations. Care shall be taken to prevent damage and injury to personnel, vessels, and vehicles using roadways, or areas accessible to pedestrians. Devices shall be provided and maintained by the Contractor as required to prevent such occurrences. Material or items falling onto roadways shall be promptly removed at the Contractor's expense.

3. Land Resources:
   a. Except in areas indicated to be cleared or excavated, the Contractor shall not remove, cut, deface, injure, or destroy trees, shrubs, or vegetation. No ropes, cables, or guys shall be fastened or attached to any existing nearby trees for anchorage unless otherwise permitted by the Project Manager. Where such use is permitted, the Contractor shall be responsible for any resulting damage.

   b. The use of herbicides is not permitted unless otherwise specified.

   c. The Contractor shall submit a plan for protecting existing trees and vegetation that are to remain and that may be injured, bruised, defaced, or otherwise damaged by construction operations. Rocks that are displaced into uncleared areas shall be removed. Monuments, markers, and works of art shall be protected prior to the start of the operations. A preconstruction survey, including photographs, shall be performed by the Contractor, and a written report of the survey shall be furnished to SEPTA within five (5) days of its request by the Project Manager.
d. Repair and Restoration: All trees, vegetation and other landscape features that are to remain and become scarred or damaged by the Contractor's equipment or operations shall be repaired and restored to their original condition at the Contractor's expense. The Project Manager shall approve the repair and restoration program prior to its initiation and after completion.

4. Water Resources: At all times, measures shall be taken to prevent oil, gasoline, and other hazardous substances from entering the ground, drainage areas, sewers, streams, and other local bodies of water.

5. Wildlife Resources: The Contractor shall not disturb native habitat adjacent to the project construction area.

D. Erosion and Sediment Controls:

1. Burning of ground cover shall not be permitted.

2. The Contractor shall conform to all applicable requirements of the Department of Environmental Resources of the Commonwealth of Pennsylvania with respect to erosion and sediment control measures to prevent discharge into storm water discharge systems and active waterways.

E. Toxic Substances:

1. The Contractor shall comply with the Toxic Substance Control Act, P.L. 94-469 (TSCA).
   a. No toxic chemical substance, mixture, equipment, container, sealant, coating, or dust-control agent shall be used except in accordance with all provisions of the TSCA as interpreted by the rules and regulations of 40 CFR 761.
   b. Any toxic chemical substance, mixture, equipment, container, sealant, coating, or dust-control agent found stored within the project area shall be immediately reported to the Project Manager in writing and Work shall be stopped in the area. The Project Manager shall make arrangements for the removal of the toxic materials, after which the Contractor may continue work in the area.

F. Control and Disposal of Chemical and Sanitary Wastes:
1. Trash shall be picked up and placed in containers that shall be emptied on a regular schedule. Handling and disposal shall be so conducted as to prevent contamination of the site and other areas, and shall not be disposed of in wetlands or burned on the right-of-way. On completion, the area shall be left clean and in natural condition.

2. Disposal of rubbish and debris shall be as follows: The Contractor shall transport all waste, including excess excavated material, off the site and dispose of it in a manner that complies with the Federal, Commonwealth, and Local requirements. The Contractor shall secure a permit or license prior to transporting any material off the site. Waste materials shall not be burned on the site.

3. The Contractor shall transport the garbage to a pickup point or disposal area.

4. Chemical waste shall be stored in corrosion-resistant containers, removed from the project site, and disposed of as necessary, but not less frequently than monthly. Disposal of chemical waste shall be in accordance with standard established practices as approved by the Project Manager. Fueling and lubricating of equipment and motor vehicles on the site shall be conducted in a manner that affords the maximum protection against spills and evaporation. Lubricants to be discarded, including burned oil, shall be disposed of in accordance with approved procedures meeting federal, Commonwealth, and local regulations. For oil and hazardous material spills that may be large enough to violate federal, Commonwealth, or local regulations, the Project Manager shall be notified immediately.

G. Dust Control:

1. Dust shall be kept down at all times, including non-Working hours, weekends, and holidays. Soil at the site, station platforms, haul roads, and other areas disturbed by the Contractor’s operations and materials stockpiled for the project shall be treated with dust suppressors or covered to control dust. Dry power brooming shall not be permitted. Vacuuming, wet mopping, wet sweeping, or wet power brooming shall be used instead. Air blowing shall be permitted only for cleaning off non-particle debris, such as that from reinforcing bars. Sandblasting shall not be permitted except as otherwise specified elsewhere. Only wet cutting of concrete block, concrete, and asphalt shall be permitted.

2. The Contractor shall comply with all applicable provisions of the National Emission Standards for Asbestos (40 CFR 61 Subpart B).
3. The Contractor shall inspect all vehicles for dirt prior to their leaving the construction site. Dirt, soil, and rubble likely to be dislodged during transit shall be removed from the trucks and other vehicles prior to leaving the site.

4. The Contractor shall ensure that equipment transporting material to and from the site that may become airborne is covered.

5. The Contractor shall not cause or permit fugitive particulate matter to be emitted into the outdoor atmosphere from any source such that emissions are visible beyond the project property line.

1.13 PROTECTION OF EXISTING WATER AND SEWER LINES

A. When the equipment axle load exceeds 15 tons, the Contractor shall provide and work from timber mats placed over existing underground water lines and sewer lines.

1.14 NOISE CONTROL

A. General:

1. The Contractor shall provide working machinery, vehicles, and equipment with efficient noise suppression devices and employ other noise abatement measures necessary for protection of employees, public, and the surrounding areas.

2. The Contractors shall protect employees, the public, and the residents against noise exposure in accordance with the requirements of the Occupational Safety and Health Act of 1970 and current statutory noise limits set by OSHA.

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SECTION 01064A

RAILROAD SAFETY REQUIREMENTS FOR WORK ON AMTRAK PROPERTY

PART 1   GENERAL

1.01 DESCRIPTION

A. This Section specifies the general requirements and the safety procedures and protection regulations governing the Contractor’s activities when entering and working upon Amtrak property and/or Amtrak controlled tracks.

B. This Section is in accordance with Amtrak Engineering Practice EP3014, Specification 01141A Safety and Protection of Railroad Traffic and Property, to establish a system of uniform practices, notices, and instructions for the Amtrak Engineering Department, providing current, permanent, and temporary departmental procedures and policies.

C. In addition, the contractors are required to follow any applicable additional Amtrak operational requirements including, but not limited to shoring practices, work on overhead bridges, storm water discharge on right of way, and rights of access to property.

1.02 RELATED WORK

A. Section 01041: Project Coordination.

B. Section 01060: Regulatory Requirements and Safety.

C. Section 01100: Special Project Procedures.

D. Section 01400: Quality Requirements

E. Section 01500: Construction Facilities and Temporary Controls.

1.03 QUALITY ASSURANCE

A. Refer to Section 01060 - 1.03.

1.04 SAFETY REQUIREMENTS

A. General:

1. The information contained in this Section is intended to provide guidance and safety precautions to the Contractor when working on a live rail line.
The Contractor is advised that National Railroad Passenger Corporation (Amtrak) and SEPTA will operate trains over this location during the performance of Work under the Contract, except as otherwise specified. The term Railroad, when used in this Section, is defined as any railroad operating on tracks in or near the work area including Amtrak and SEPTA.

2. The Contractor shall comply with all pertinent regulations.

B. Responsibility:

1. The Work covered by the Contract involves safety of persons and property on a live electrified rail line. Therefore, relevant skill and experience is required of the Contractor to do its Work safely. The Contractor shall be responsible for the safety of its construction operations. The Contractor shall be required to post adequate watchpersons and/or protective devices to protect its work crews, equipment, and the work site as directed by the Amtrak Representative. Pertinent safety rules that shall be followed are listed in, but not limited to, Part 3 of this Section.

2. The Contractor shall exercise proper care at all times.

C. Operations:

When work is being performed under active train operations, the safety and continuity of operation of the trains by the railroad shall be of the first importance. They shall, at all times, be protected and the Contractor shall arrange the work accordingly. Whenever the Work may affect the safety or movement of trains, the method of doing such Work, together with the proposed sequence of operations and time schedules for same, shall be submitted to the Amtrak Representative for prior approval.

No work shall be started or prosecuted until such approval has been obtained. However, such approval shall not be considered as a release of Contractor from responsibility for any damage to the railroad by the acts of the Contractor, its employees, and/or its subcontractor’s employees.

1. In cases where the work may cause fouling, the Contractor is responsible for submitting a specific outage or fouling request 21 days in advance of the work in order to avoid delays to the work. Amtrak requires 14 days to assign personnel once a fouling or outage request is approved. The contractor will be informed of this notification time during project start-up.

2. In the event of an unplanned discontinuation of train service due to the Contractor’s operations, the Contractor is not only liable for any injury or damage that might occur, but also for the full cost of any
detour of train traffic, shuttle bus service, and any associated costs as determined by Amtrak.

D. Personnel:

1. **Chief Engineer:** Amtrak's Chief Engineer and/or his duly authorized representative.

2. **Amtrak Representative:** The duly authorized representative of the Chief Engineer.

3. **Watchmen:** Watchmen are responsible for the safety and continuity of operations. Any sharing of protective duties between Amtrak and the Contractor within the Work site can be considered coincidental.

4. **Train Dispatcher:** The Train Dispatcher shall have sole authority to direct the stoppage of trains.

5. **Pilots:** If the Contractor wishes to occupy live or operating tracks with On-Track equipment, the Contractor shall request a pilot who will obtain exclusive track occupancy on the live track.

6. **SEPTA Project Manager:** The SEPTA Project Manager, or a duly authorized representative, is the contractor's primary contact in matters related to the operation of the construction site. Contacts with Amtrak shall go through the SEPTA Project Manager, however Amtrak personnel are free to contact the contractor directly when safety issues arise during construction. The Project Manager, or a duly authorized representative, is also responsible for supporting the Contractor’s planning and coordination of their safety effort related to SEPTA's Operations and Facilities.

E. Contractor's Personnel:

1. **Protection Assurance Representative:** The Contractor’s Protection Assurance Representative (representative) may be the Superintendent, Safety Officer, or responsible foreperson. The representative shall be present at all times when the Contractor's employees are working within the Railroad operating envelope. The representative must ensure that the requisite On-Track protection job briefings are held and all employees engaged in work requiring On-Track protection attend. In general, the representative shall be responsible for day-to-day oversight of the Contractor’s gang watchperson and employees so that they are working safely according to all parts of this Section and to coordinate construction activities with the Amtrak Representative.
2. Gang Watchperson: The role of the Contractor’s gang watchperson is solely for the purpose of safety for the Contractor's employees when external influences, i.e., rail traffic or highway traffic, may expose the workers to a safety hazard. One or more gang watchpersons shall be on site with each work crew at all times. If it becomes necessary for a watchperson to leave the site, work shall be suspended until he/she returns or is replaced by another qualified gang watchperson.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 PRE-ENTRY MEETING

A. Before entry of the Contractor onto Railroad's property (even if the property is open to the public such as a station facility), a pre-entry meeting shall be held at which time the Contractor shall submit, for written approval of the Chief Engineer, plans, computations and a detailed description of proposed methods for accomplishing the work, including methods for protecting Railroad's traffic. Any such written approval shall not relieve the Contractor of their complete responsibility for the adequacy and safety of their operations.

3.02 RULES, REGULATIONS, AND REQUIREMENTS SAFETY AND PROTECTION OF RAILROAD TRAFFIC AND PROPERTY

A. Railroad traffic shall be maintained at all times with safety and continuity, and the Contractor shall conduct their operations in compliance with all rules, regulations, and requirements of Railroad (including these Specifications) with respect to any work performed on, over, under, within or adjacent to Railroad’s property. The Contractor shall be responsible for acquainting themselves with such rules, regulations and requirements. Any violation of Railroad’s safety rules, regulations, or requirements shall be grounds for the immediate suspension of the Contractor’s work, and the re-training of all personnel at the Contractor’s expense.

3.03 MAINTENANCE OF SAFE CONDITIONS

A. If tracks or other property of Railroad are endangered during the work, the Contractor shall immediately take such steps as may be directed by Railroad to restore safe conditions, and upon failure of the Contractor to immediately carry out such direction, Railroad may take whatever steps are reasonably necessary to restore safe conditions. All costs and expenses of restoring safe conditions, and of repairing any damage to Railroad’s trains, tracks, right-of-way, or other property caused by the operations of the Contractor shall be paid by the Contractor.
3.04 PROTECTION IN GENERAL

A. The Contractor shall consult with the Chief Engineer to determine the type and extent of protection required to insure safety and continuity of Railroad traffic. Any Inspectors, Track Foremen, Track Watchmen, Flagman, Signalmen, Electric Traction Linemen, or other employees deemed necessary by Railroad, at its sole discretion, for protective services shall be obtained from Railroad by the Contractor. The cost of same shall be paid directly to Railroad by SEPTA in accordance with the requirements elsewhere in the Specifications. The provision of such employees by Railroad, and any other precautionary measures taken by Railroad, shall not relieve the Contractor from their complete responsibility for the adequacy and safety of their operations.

3.05 PROTECTION FOR WORK NEAR ELECTRIFIED TRACK OR WIRE

A. Whenever work is performed in the vicinity of electrified tracks and/or high voltage wires, particular care must be exercised, and Railroad’s requirements regarding clearance to be maintained between equipment and tracks and/or energized wires, and otherwise regarding work in the vicinity of electrified tracks, must be strictly observed. No employees or equipment will be permitted to work near overhead wires, except when protected by a Class ‘A’ employee of Railroad. Permittee and/or Contractors must supply an adequate length of grounding cable (4/0 copper with approved clamps) for each piece of equipment working near or adjacent to any overhead wire.

3.06 FOULING OF TRACK OR WIRE

A. No work will be permitted within 25 feet of the centerline of nearest track or the energized wire or have potential of getting within 25 feet of nearest track wire without the approval of the Chief Engineer’s representative. The Contractor shall conduct their work so that no part of any equipment or material shall foul an active track or overhead wire without the written permission of the Chief Engineer’s representative. When the Contractor desires to foul an active track, they must provide the Chief Engineer’s representative with their site-specific work plan a minimum of 28 working days in advance, so that, if approved, arrangements may be made for proper protection of Railroad. Any equipment shall be considered to be fouling a track or overhead wire when located:

1. within 15 feet from the centerline of the track or within 15 feet from the wire, or

2. in such a position that failure of same, with or without a load, would bring it within 15 feet from the centerline of the track or within 15 feet
B. If acceptable to the Chief Engineer’s representative, a safety barrier (approved temporary fence or barricade) may be installed at 15 feet from centerline of track or overhead wire to afford the Contractor with a work area that is not considered fouling. Nevertheless, protection personnel may be required at the discretion of the Chief Engineer’s representative.

3.07 TRACK OUTAGES

A. The Contractor shall verify the time and schedule of track outages from Railroad before scheduling any of their work on, over, under, within, or adjacent to Railroad’s right-of-way. Railroad does not guarantee the availability of any track outage at any particular time. The Contractor shall schedule all work to be performed in such a manner as not to interfere with Railroad operations. The Contractor shall use all necessary care and precaution to avoid accidents, delay, or interference with Railroad's trains or other property.

3.08 DEMOLITION

A. During any demolition, the Contractor must provide horizontal and vertical shields, designed by a Professional Engineer registered in the state in which the work takes place. These shields shall be designed in accordance with the Railroad's specifications and approved by the Railroad, so as to prevent any debris from falling onto the Railroad's right-of-way or other property. A grounded temporary vertical protective barrier must be provided if an existing vertical protective barrier is removed during demolition.

B. Ballasted track structure shall be kept free of all construction and demolition debris. Geotextiles or canvas shall be placed over the track ties and ballast to keep the ballast clean.

3.09 EQUIPMENT CONDITION

A. All equipment to be used in the vicinity of operating tracks shall be in “certified” first-class condition so as to prevent failures that might cause delay to trains or damage to Railroad’s property. All equipment working on the NEC (Northeast Corridor) that utilizes a boom will need to have that boom certified safe by an independent crane inspector.

B. No equipment shall be placed or put into operation near or adjacent to operating tracks without first obtaining permission from the Chief Engineer’s representative. Under no circumstances shall any equipment or materials be placed or stored within 25 feet from the centerline of an outside track, except as approved by the Site Specific Safety Work Plan.
To insure compliance with this requirement, the Contractor must establish a 25-foot foul line prior to the start of work by either driving stakes, taping off or erecting a temporary fence, or providing an alternate method as approved by the Chief Engineer’s representative. The Contractor will be issued warning stickers which must be placed in the operating cabs of all equipment as a constant reminder of the 25-foot clearance envelope.

3.10 STORAGE OF MATERIALS AND EQUIPMENT

A. No material or equipment shall be stored on Railroad’s property without first having obtained permission from the Chief Engineer. Any such storage will be on the condition that Railroad will not be liable for loss of or damage to such materials or equipment from any cause.

B. If permission is granted for the storage of compressed gas cylinders on Railroad property, they shall be stored a minimum of 25 feet from the nearest track in an approved lockable enclosure. The enclosure shall be locked when the Contractor is not on the project site.

3.11 CONDITION OF RAILROAD’S PROPERTY

A. The Contractor shall keep Railroad’s property clear of all refuse and debris from its operations. Upon completion of the work, the Contractor shall remove from Railroad’s property all machinery, equipment, surplus materials, falsework, rubbish, temporary structures, and other property of the Contractor and shall leave Railroad’s property in a condition satisfactory to the Chief Engineer.

3.12 SAFETY TRAINING

A. All individuals, including representatives and employees of the Contractor, before entering onto Railroad’s property or coming within twenty-five (25) feet of the centerline of the track or energized wire shall first attend Railroad’s Safety Contractor/Lessee Employee Training Class. The Safety Orientation Class will be provided by Railroad’s Safety Representative at the Contractor’s expense. A photo I.D. will be issued and must be worn/displayed while on Railroad property. All costs of complying with Railroad’s safety training shall be at the sole expense of the Contractor. The Contractor shall appoint a qualified person as their Safety Representative (a.k.a. Contractor’s Protection Assurance Representative). The Safety Representative shall continuously assure that all individuals comply with Railroad’s safety requirements. All safety training records shall be maintained with site specific work plan.

3.13 NO CHARGES TO RAILROAD

A. It is expressly understood that neither these Specifications, nor any document to which they are attached, include any work for which Railroad
is to be billed by the Contractor, unless Railroad gives a written request that such work be performed at Railroad's expense.

### 3.14 GENERAL SAFETY RULES

The following safety rules are considered especially applicable to all of the Contractor’s employees with regard to conduct while on Amtrak property. The Contractor’s foreperson or gang watchperson will be responsible to insure the safety of all the Contractor’s personnel. The Contractor shall furnish and equip its foreperson and/or gang watchperson with the equipment as specified by Amtrak to warn the Contractor’s personnel of the approach of trains.

**A.** Contractor-employed supervisors, foreperson, and gang watchpersons shall be responsible for the safety, safety instructions, and safe performance of all employees under their immediate supervision. They must see that all employees working under their supervision receive warnings of approaching trains and other equipment in time to reach a safe place as per the Amtrak’s Roadway Worker rules. Inexperienced employees must be instructed by immediate supervisors of the safe methods of performing their duties.

**B.** All Contractor employees working on or near an active track must attend an On-Track protection job briefing. This briefing shall be held prior to performing any work that has the potential to foul track, or at a minimum, would require the individual to be within 25 feet of any active track or any time job conditions change such that On-Track protection procedures differ from those covered in the job briefing. An active track is any track that has the potential for train, or On-Track equipment operations.

1. The Amtrak Representative will conduct the job briefing to explain On-Track safety procedures being utilized.

2. The Contractor’s Protection Assurance Representative responsible for the overall supervision of contractor employees shall ensure that the requisite job briefings are held, that all employees attend, and sign the job briefing form. At a minimum, the job briefings must cover the following information, if applicable:

   a. The identification of the Amtrak Representative.

   b. A review of operational and safety conditions.

   c. The means by which On-Track safety is to be provided.

   d. The positioning of any individuals responsible for providing warning to roadway workers.
e. The type of signals that will be used to convey the warning of an approaching train.

f. The location where roadway workers will be required to go to clear for trains.

g. The identification of the Amtrak employee responsible for communicating with trains.

h. The type of signals that will be used to signal it is safe to resume work.

3. The Contractor shall provide SEPTA a copy of all written records of individuals attending the job briefing.

C. The Contractor shall require employees to carry hand held lights, as approved by the Amtrak representative, when working from dusk to dawn, in tunnels or when visibility is restricted.

D. The Contractor's employees shall consider all tracks as operating tracks and be on the alert for trains operating in either direction at all times, and walk facing the direction from which trains in regular operations will approach. In the event that track area visibility remains poor after institution of remedial measures (as described in C above), work in the track area may be restricted.

E. The Contractor's employees shall STOP before crossing any tracks and look for trains approaching in either direction. The Contractor shall instruct employees not to cross tracks unless there is time to walk slowly, not to take chances, and not to step on the head of the rail.

F. The Contractor's employees shall dress appropriately to insure that clothing cannot catch onto any part of a moving car.

G. The Contractor's employees shall not step into the track area behind stopped rail cars, particularly those arriving at stations, due to the possibility of rail cars being moved in reverse directions.

H. The Contractor's employees shall not attempt to carry heavy materials across tracks without permission of proper authorities.

I. The Contractor's employees shall keep hands and feet clear of power switches, switches, switch equipment, and frogs.

J. Catenary and Overhead Electrical Lines:

1. When handling work near overhead wires, the Contractor's employees shall observe the following:
a. All overhead wires, including catenary, transmission, and signal lines in electrified zones, shall be considered energized at all times.

b. Insulating covering of wire shall not be depended upon for protection against shock.

c. No employee of the Contractor shall do any work near electrical wires or apparatus where it is possible for any part of the employee's body or tools and material with which the employee is working to come within twenty-five (25) feet of such wires, unless an Amtrak Representative permits the work and is assigned to observe the safety of the operation.

d. When equipment is used in electrified territory or in the vicinity of Verizon Telephone, PECO, as well as Railroad overhead wires, the Contractor must exercise special care to safeguard all persons in the area. Special attention must be given in the vicinity of overhead bridges and other structures where the wires may be depressed.

e. Use of metal ladders is forbidden.

2. In a case of electrical contact, personal judgment and initiative has to be used, bearing in mind that the rescuer's safety should not be imperiled. Contact with a live overhead wire may prove fatal in a matter of seconds. The most important thing is to stop the flow of electricity through the victim's body and then apply mouth-to-mouth resuscitation (or CPR when necessary and if qualified to do so) until he or she recovers consciousness or trained help arrives. Once a victim is freed from the overhead wire, do not move him or her unless they can do so under their own power. Except for qualified rescuers, moving an injured person may result in further injury.

END OF SECTION
SECTION 01100 - SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 DESCRIPTION

A. This section outlines the procedural requirements so the contractor may plan and be granted concurrence for track outages, single tracking, service disruptions, and/or diversions specified under this contract.

B. Work crews and equipment which SEPTA will make available to a Contractor.

C. The Contractor requesting approval to procure and operate track cars and/or high rail vehicles shall conform to the procedures detailed below.

1.02 RELATED WORK

A. Section 01010: Summary of Work

B. Section 01060: Regulatory Requirements and Safety.

C. Section 01064A: Railroad Safety Requirements for Work on Amtrak Property.

D. Section 01141A: Safety and Protection of Railroad Traffic and Property.


1.03 SUBMITTALS

A. Requests for service outages and Site Specific Work Plans (SSWPs) shall be submitted to the Project Manager (PM) by the Contractor for concurrence 60 calendar days prior to outage request. The Project Manager (PM) will be responsible for coordination and submitting the contractor’s means and methods of construction and continuing construction coordination to Amtrak’ Chief Engineer or duly authorized representative for review, coordination and approval of Amtrak. The PM will respond within 30 calendar days of receipt of the submittal.

Once reviewed by SEPTA/Amtrak, any changes to the SSWP will be subject to a subsequent review by SEPTA/Amtrak. These submittals must be annotated and reissued weekly to reflect changes to the scope.
or schedule created during the 60-day period between the original issue and the date of operation. Not later than 15 days before a planned outage, a new revision of the submittal incorporating all changes and reflecting the final work plan must be submitted to the PM.

B. Should the Contractor desire to cancel an approved outage, the written cancellation request shall be received by the PM a minimum of five (5) calendar days prior to the outage date so that affected SEPTA/Amtrak operations can be rescheduled. Late cancellation requests shall result in the outage costs being assessed against the Contractor.

1.04 DEFINITIONS

A. “Track outage” is defined as a removal from operating train service of a single or double operating mainline track for short periods of time.

B. “Fouling” is defined as any operation which encroaches within 25 feet of the centerline of the near track or energized wire. Equipment is considered to be fouling a track or overhead wire when located in such a position that failure, with or without load, would bring it within 15 feet from the centerline of track or wire.

C. “Non-track outage work” is all other work, specifically work that is performed more than 25 feet from the near rail of track and does not require track occupancy or track outages. To minimize track occupancy or track outage durations, certain non-track outage work must be accomplished prior to the actual track outage work.

D. “Service outage” is defined as a stoppage of revenue service on the Northeast Corridor (NEC) between 12:00 p.m. and 4:30 a.m. with the system de-energized for access on the tracks.

1.05 REQUEST FOR TRACK USAGE (Outages, shutdown, rail diversions, and single tracking)

A. The Request for Service as defined above shall be a time-scaled logic network. This network is to fully detail the extent of work proposed and the Contractor’s plan and means for accomplishing same in the inclusive period. Specific separate operations and planned service disruptions should be highlighted in these submittals.

1. The SSWP shall provide a description of work; time scaled hourly logic network, breakdown of labor force, materials and the type of equipment that will be utilized. The SSWP shall include Contractor’s watchperson, required SEPTA flagging and support, construction
methods, arrangements for emergency clearing and restoration of
service, and sketches for defining the configuration of rail service
and other operational elements at the end of the Contractor's
outage.

2. All work by SEPTA Force Account Track, Signals, etc. or other
contracts that are defined in Section 01010 and subsequent
reviews that has the potential of delaying either the work by this
Contractor, or the restoration of service, must be identified clearly in
terms of scope and schedule for coordination with others.

B. Amtrak and SEPTA will not grant outage or single tracking until the
Contractor's SSWP has been reviewed by the Engineer and approved by
Amtrak and SEPTA in writing.

Any equipment to occupy space or operate on the NEC will need to be
inspected by Amtrak.

The Contractor shall not perform any of the work requiring as referred
above until written approval has been received from Amtrak and SEPTA.

1.06 REQUEST FOR AMTRAK SUPPORT

A. See Section 01141A.

B. Flagging

C. Signal

D. Power

1.07 REQUEST FOR AREA RELOCATIONS

(As Defined in the Contract)

1.08 REQUEST FOR AMTRAK SERVICES

A. Work Crews

B. Professional

C. Equipment
1.09 TRACK CAR/HIGH RAIL VEHICLE (TC/HRV)

A. The contractor shall formally request by submittal, all track or hi-rail equipment proposed to be utilized for the work of this contract. The submittal shall be directed to the Project Manager for review and approval. This submittal shall include the equipment’s physical characteristics which include but are not limited to the following:

1. Manufacturer’s Catalog cuts by showing all dimensions.

2. Any subsequent modifications noted and dimensioned.

3. Vehicle Identification Number or serial number.

4. Must have a current Pennsylvania vehicle safety inspection sticker if rubber tired.

5. Limiting physical dimensions of the operating mode if appropriate.

6. The PM will provide a clearance diagram and attach to their section if available. The contractor shall also provide the following on-board equipment:

   a. All powered vehicles will be equipped with a steering wheel lock.

   b. Hydraulic outriggers will be equipped with locking pins.

   c. Guards will be installed at all wheel pinch points.

   d. All powered vehicles will have an ABC type fire extinguisher.

   e. A tow bar and coupler adapter for rescue.

   f. A clearance placard in the cab using the correct print.

   g. Boom tie-down if applicable.

   h. Wheel chocks to secure on rail if left unattended.

   i. Railroad lighting package to provide marker lights for the end of consist.

   j. Horn

7. Each vehicle shall have a unit number clearly marked on its exterior.
8. If operation of multiple consists is planned, each configuration shall be submitted for review as “Arrangement A, B, C, etc.”. The traction and braking effort in comparison to the prime mover shall be calculated and provided.

9. A recovery plan shall also be provided for review detailing how the contractor proposes to re-rail or recover disabled on-track equipment once it is operating on the rail.

B. Testing

SEPTA will inspect the equipment and grant approval if it meets safety standards or refuse operation of the equipment if it is not in safe condition, before any equipment may be placed on the rail. Any repairs or modifications found to be required will be done at no cost to SEPTA and a yard retest will be held. SEPTA will yard test equipment to determine actual performance in curves and crossover before granting permission for use. If the equipment is utilized to deliver materials the loading shall also be reviewed for clearance. All requested consists will be tested at this time.

1. If any modifications are made after the initial yard test, the Contractor will notify the Project Manager in writing with details and receive approval before using it again on track.

2. If the approved vehicle or track car is taken off the project for another job and then returned, the contractor must certify in writing that it is still in its original condition. If there is any question, a yard test and inspection will be scheduled at no additional cost to SEPTA.

C. Operation

1. A qualified SEPTA employee will assist the Contractor to place the equipment on the track. The SEPTA pilot must be on board when such equipment enters a siding or a point of access to the main rail. The SEPTA pilot as a minimum will ride the vehicle to and from the work zone.

2. The Contractor shall operate this equipment within the work zone specified in the Bulletin Order issued for that work. In addition, the following rules apply to the Contractor’s personnel when placing equipment on the rail after receiving authorization from a qualified SEPTA Employee.

   a) The TC/HRV driver shall perform a visual inspection to see that the track car and its consist is in a safe operating condition before
being operated. Track Cars shall not be operated if found in an unsafe condition.

b) The TC/HRV shall display a white light to the front and red light to the rear when visibility is restricted and at night. High Rail Vehicles shall have headlights on high beam when moving.

c) The TC/HRV shall not trail through spring switches or semi-automatic switches unless switches are properly lined.

d) The maximum speed for the movement of any TC/HRV is governed by the appropriate Operating Rule Book.

e) The TC/HRV shall be operated at a speed, which will permit them to stop short of any obstruction, improperly lined switch, or broken rail.

3. The Contractor shall include training of track car/HRV drivers in the appropriate part of their safety plan, and develop and maintain an updated log of these personnel.

4. The Recovery plan will be kept in each powered vehicle and updated as changes are made.

D. All equipment shall comply with the appropriate requirements of 49 CFR part 214; Final Rule, Roadway Maintenance Machine Safety.

1.10 PROJECT CONDITIONS

A. The scheduling of the project work must consider the need to maintain access to and operations within the station and on the railroad at all times.

B. The Contractor is encouraged to prefabricate units to the extent possible as non-track outage work and then erect into final position to minimize the impact on rail operations and the need for outages.

C. Track outages and service outages will be between 12:00 p.m. and 4:30 a.m., as approved by Amtrak.

D. Amtrak operates on the NEC 24 hours a day, 7 days a week. Therefore, there is a very short window of time during the night that all four tracks and the high-tension power lines above can be de-energized at one time. It is estimated that this window may be limited to approximately one
hour. The Contractor’s means and methods for installing the overpass bridge must consider this limited window of time for bridge installation.

1.11 DAMAGES FOR FAILURE TO RETURN TO SERVICE

A. In the event of an unplanned discontinuation of train service due to the Contractor’s operations, the Contractor is not only liable for any injury or damage that might occur, but also for the full cost of any detour of train traffic, shuttle bus service, and any associated costs.

END OF SECTION
SECTION 01141A
SAFETY AND PROTECTION OF RAILROAD TRAFFIC AND PROPERTY

PART 1   GENERAL

1.01   SCOPE

A. This specification describes the safety procedures and protection provisions for Contractors and Permittees entering and working upon railroad property.

B. Use of this specification is as required by Amtrak, as described in Amtrak Engineering Practice EP3014.

1.02   RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.03   DEFINITIONS

A. CHIEF ENGINEER: Amtrak Vice President, Chief Engineer.

B. RAILROAD: National Railroad Passenger Corporation (Amtrak), and/or the duly authorized representative.

C. ENGINEERING PRACTICE: Amtrak Engineering Practices establish a system of uniform practices, notices, and instructions for the Amtrak Engineering Department, providing current, permanent and temporary, departmental procedures and policies.

PART 2   PRODUCTS (Not Used)

PART 3   EXECUTION

3.01   PRE-ENTRY MEETING

A. Before entry of Permittee and/or Contractors onto Railroad’s property, a pre-entry meeting shall be held at which time Permittee and/or Contractors shall submit for written approval of the Chief Engineer, plans, computations and a detailed description of proposed methods for accomplishing the work, including methods for protecting Railroad’s traffic. Any such written approval shall not relieve Permittee and/or Contractor of their complete responsibility for the adequacy and safety of their operations.
3.02 RULES, REGULATIONS, AND REQUIREMENTS

A. Railroad traffic shall be maintained at all times with safety and continuity, and Permittee and/or Contractors shall conduct their operations in compliance with all rules, regulations, and requirements of Railroad (including these Specifications) with respect to any work performed on, over, under, within or adjacent to Railroad’s property. Permittee and/or Contractors shall be responsible for acquainting themselves with such rules, regulations, and requirements. Any violation of Railroads safety rules, regulations, or requirements shall be grounds for the immediate suspension of the Permittee and/or Contractor work, and the re-training of all personnel, at the Permittee’s expense.

3.03 MAINTENANCE OF SAFE CONDITIONS

A. If tracks or other property of Railroad are endangered during the work, Permittee and/or Contractor shall immediately take such steps as may be direct by Railroad to restore safe conditions, and upon failure of Permittee and/or Contractor to immediately carry out such direction, Railroad may take whatever steps are reasonably necessary to restore safe conditions. All costs and expenses of restoring safe conditions, and of repairing any damage to Railroad’s trains, tracks, right-of-way, or other property caused by the operations of Permittee and/or Contractors, shall be paid by Permittee.

3.04 PROTECTION IN GENERAL

A. Permittee and/or Contractors shall consult with the Chief Engineer to determine the type and extent of protection required to insure safety and continuity of railroad traffic. Any Inspectors, Track Foremen, Track Watchmen, Flagman, Signalmen, Electric Traction Linemen, or other employees deemed necessary by Railroad, at its sole discretion, for protective services shall be obtained from Railroad by Permittee and/or Contractors. The cost of same shall be paid directly to Railroad by Permittee. The provision of such employees by Railroad, and any other precautionary measures taken by Railroad, shall not relieve Permittee and/or Contractors from their complete responsibility for the adequacy and safety of their operations.

3.05 PROTECTION FOR WORK NEAR ELECTRIFIED TRACK OR WIRE

A. Whenever work is performed in the vicinity of electrified tracks and/or high voltage wires, particular care must be exercised, and Railroad’s requirements regarding clearance to be maintained between equipment and tracks and/or energized wires, and otherwise regarding work in the vicinity of electrified tracks, must be strictly observed. No employees or equipment will be permitted to work near overhead wires, except when
protected by Class A employee of Railroad. Permittee and/or Contractors must supply an adequate length of grounding cable (4/0 copper with approved clamps) for each piece of equipment working near or adjacent to any overhead wire.

3.06 FOULING OF TRACK OR WIRE

A. No work will be permitted within 25 feet of the centerline of track or the energized wire or have potential of getting within twenty-five (25) feet of track wire without the approval of the Chief Engineer’s representative. Permittee and/or Contractors shall conduct their work so that no part of any equipment or material shall foul an active track or overhead wire without the written permission of the Chief Engineer’s representative. When Permittee and/or Contractors desire to foul an active track, they must provide the Chief Engineer’s representative with their site-specific work plan a minimum of 21 working days in advance, so that, if approved, arrangements may be made for proper protection of Railroad. Any equipment shall be considered to be fouling a track or overhead wire when located (a) or (b) in such a position that failure of same, with or without a load, would bring it within 15 feet from the centerline of track or within 15 feet from the wire and requires the presence of the proper Railroad protection personnel.

B. If acceptable to the Chief Engineer’s representative, a safety barrier (approved temporary fence or barricade) may be installed at 15 feet from centerline of track or overhead wire to afford the Permittee and/or Contractor with a work area that is not considered fouling. Nevertheless, protection personnel may be required at the discretion of the Chief Engineer’s representative.

3.07 TRACK OUTAGES

A. Permittee and/or Contractors shall verify the time and schedule of track outages from Railroad before scheduling any of their work on, over, under, within, or adjacent to Railroad’s right-of-way. Railroad does not guarantee the availability of any track outage at any particular time. Permittee and/or Contractors shall schedule all work to be performed in such a manner as not to interfere with Railroad operations. Permittee and/or Contractors shall use all necessary care and precaution to avoid accidents, delay, or interference with Railroad’s trains or other property.

3.08 DEMOLITION

A. During any demolition, the Contractor must provide horizontal and vertical shields, designed by a Professional Engineer registered in the state in which the work takes place. These shields shall be designed in accordance with the Railroad’s specifications and approved by the
Railroad, so as to prevent any debris from falling onto the Railroad’s right-of-way property. A grounded temporary vertical protective barrier must be provided if an existing vertical protective barrier is removed during demolition. In addition, if any openings are left in an existing bridge deck, a protective fence must be erected at both ends of the bridge to prohibit unauthorized persons from entering onto the bridge.

B. Ballasted track structure shall be kept free of all construction and demolition debris. Geotextiles or canvas shall be placed over the track ties and ballast to keep the ballast clean.

3.09 EQUIPMENT CONDITION

A. All equipment to be used in the vicinity of operating tracks shall be in "certified" first-class condition so as to prevent failures that might cause delay to trains or damage to Railroad’s property. No equipment shall be placed or put into operation near or adjacent to operating tracks without first obtaining permission from the Chief Engineer’s representative. Under no circumstances shall any equipment or materials be placed or stored within 25 feet from the centerline of an outside track, except as approved by the Site Specific Safety Work Plan. To insure compliance with this requirement, Permittee and/or Contractors must establish a 25-foot foul line prior to the start of work by either driving stakes, taping off or erecting a temporary fence, or providing an alternate method as approved by the Chief Engineer’s representative. Permittee and/or Contractors will be issued warning stickers which must be placed in the operating cabs of all equipment as a constant reminder of the 25-foot clearance envelope.

3.10 STORAGE OF MATERIAL AND EQUIPMENT

A. No material or equipment shall be stored on Railroad’s property without first having obtained permission from the Chief Engineer. Any such storage will be on the condition that Railroad will not be liable for loss of or damage to such materials or equipment from any cause.

B. If permission is granted for the storage of compressed gas cylinders on Railroad property, they shall be stored a minimum of 25 feet from the nearest track in an approved lockable enclosure. The enclosure shall be locked when the Permittee and/or Contractor is not on the project site.

3.11 CONDITION OF RAILROAD’S PROPERTY

A. Permittee and/or Contractors shall keep Railroad’s property clear of all refuse and debris from its operations. Upon completion of the work, Permittee and/or Contractors shall remove from Railroad’s property all machinery, equipment, surplus materials, falsework, rubbish, temporary structures, and other property of the Permittee and/or Contractors and
shall leave Railroad’s property in a condition satisfactory to the Chief Engineer.

3.12 SAFETY TRAINING

A. All individuals, including representatives and employees of the Permittee and/or Contractors, before entering onto Railroad’s property or coming within 25 feet of the centerline of the track or energized wire shall first attend Railroad’s Safety Contractor/Lessee Employee Training Class. The Safety Orientation Class will be provided by Railroad’s Safety Representative at Permittee’s expense. A photo I.D. will be issued and must be worn/displayed while on Railroad property. All costs of complying with Railroad’s safety training shall be at the sole expense of Permittee. Permittee and/or Contractors shall appoint a qualified person as their Safety Representative. The Safety Representative shall continuously assure that all individuals comply with Railroad’s safety requirements. All safety training records shall be maintained with site specific work plan.

3.13 NO CHARGES TO RAILROAD

A. It is expressly understood that neither these Specifications, nor any document to which they are attached, include any work for which Railroad is to be billed by Permittee and/or Contractors, unless Railroad gives a written request that such work be performed at Railroad’s expense.

END OF SECTION
SECTION 01142A

AMTRAK REVIEW OF BRIDGE ERECTION, DEMOLITION, AND OTHER CRANE/HOISTING OPERATIONS OVER RAILROAD RIGHT-OF-WAY

PART 1 GENERAL

1.01 SCOPE

A. Amtrak requires that a site-specific work plan for accomplishing hoisting operations be prepared for every applicable project, and for each type of lift on a project.

1. The plan shall demonstrate adherence to Amtrak safety rules.

2. The plan shall demonstrate constructability.

3. The plan shall minimize impact to rail operations.

4. The approved plan will provide the basis for field inspection/verification of the actual work.

B. Preparation, review, and approval of the Crane/Hoisting site-specific work plan does not relieve the Contractor from meeting other Amtrak requirements for adequate planning and documentation of proposed work procedures within the Right-of-Way of the railroad.

C. Current Amtrak safety rules shall be adhered to in every respect.

D. Use of this specification is as required by Amtrak, as described in Amtrak Engineering Practice EP3014.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.03 DEFINITIONS

D. CHIEF ENGINEER: Amtrak Vice President, Chief Engineer.

E. RAILROAD: National Railroad Passenger Corporation (Amtrak), and/or the duly authorized representative.

F. ENGINEERING PRACTICE: Amtrak Engineering Practices establish a system of uniform practices, notices, and instructions for the Amtrak
Engineering Department, providing current, permanent and temporary, departmental procedures and policies.

1.04 SUBMISSION REQUIREMENTS

A. Unless otherwise directed in the Contract, the Contractor shall submit two sets of plans and calculations to the SEPTA PM and five sets to the authorized representative of the Chief Engineer, Structures, whose name and address will be provided at the project pre-construction meeting.

B. Submitted calculations and plans shall be signed and sealed by a Professional Engineer registered in the Commonwealth of Pennsylvania.

C. The Contractor shall revise and resubmit plans and calculations as many times as necessary, until a complete and correct site-specific work plan for crane/hoisting operations has been approved.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 THE CONTRACTOR SHALL PROVIDE, AT A MINIMUM, THE FOLLOWING INFORMATION FOR REVIEW AND APPROVAL BY AMTRAK ENGINEERING STRUCTURES:

A. Plan view showing location(s) of cranes, operating radii, with delivery and/or disposal locations shown. Provide all necessary dimensions for locating the elements of the plan.

B. Plans and computations showing the weight of the pick.

C. Crane rating sheets, demonstrating that cranes are adequate for 150% of the calculated pick weight. That is, the cranes shall be capable of picking 150% of the load, while maintaining normal, recommended factors of safety. The adequacy of the crane for the proposed pick shall be determined by using the manufacturer’s published crane rating chart and not the maximum crane capacity. Crane and boom nomenclature is to be indicated.

D. Calculations demonstrating that slings, shackles, lifting beams, etc., are adequate for 150% of the calculated pick weight.

E. Location plan showing obstructions, indicated that the proposed swing is possible. “Walking” of load using two cranes will not be permitted. Rather, multiple picks and repositioning of the crane may be permitted to get the load to the needed location for the final pick, if necessary.
F. Data sheet listing types and sizes of slings and other connecting equipment. Include copies of catalog cuts for specialized equipment. Detail attachment methods on the plans.

G. A complete procedure, indicating the order of lifts and any repositioning or re-hitching of the crane or cranes.

H. If temporary shoring or support of any components is required at intermediate stages or to accommodate repositioning, the contractor shall design the shoring and foundations and submit calculations and details for same.

I. A time schedule of the various stages, as well as a schedule for the entire lifting process.

J. Verify the adequacy of the steel truss overpass for the specific pick point locations that are proposed.

END OF SECTION
SECTION 01200 - PROJECT PROGRESS MEETINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: To enable the orderly review of the progress of the Work, and to provide for systematic discussion of problems, the SEPTA Project Manager, or a designee, will conduct project meetings throughout the construction period.

B. The progress meetings are in addition to the coordination, pre-construction, and scheduling meetings noted elsewhere in the Contract Documents.

1.02 RELATED WORK

A. Agreement and Division 1.

B. The Contractor's relations with its subcontractors and discussions relative thereto are the Contractor's responsibility and are not to be agenda items in the project progress meetings.

C. The discussions and minutes of meeting shall exclude any claims related issues not directly impacting the progress of the Work, and other items for which SEPTA has provided clarifications/directives/change order(s) or otherwise closed, but remain disputed by the Contractor.

1.03 SUBMITTALS

A. Agenda items

1. To the maximum extent practicable, the Contractor shall advise the Project Manager at least 48 hours in advance of project meetings regarding items to be discussed during the meeting.

2. Technical questions or issues requiring a response from the designer of record must be submitted in writing at least three business days before the meeting.

B. Minutes:

1. The Project Manager will compile minutes of each project meeting, and will furnish one copy to the Contractor.
2. The Contractor may copy and distribute other copies as required.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

3.01 MEETING SCHEDULE

A. Project meetings will be held bi-weekly

B. The Project Manager will coordinate with the contractor(s) to establish a mutually acceptable meeting schedule.

3.02 MEETING LOCATION

The Project Manager will determine meeting location. To the maximum extent practicable, meetings will be held at the job site.

3.03 PROJECT MEETINGS

A. Attendance:

1. The Contractor’s Superintendent shall attend and participate in each project meeting and shall represent the Contractor consistent with Contract and commit the Contractor to solutions agreed upon during the project meetings.

2. Subcontractors and others may be invited to attend those project meetings in which their aspect of the Work is involved.

3. If notified of the need 5 days in advance, the SEPTA PM will request the attendance of the appropriate members of the design team to participate in technical discussions.

B. Minimum agenda for each meeting:

1. Review and revise, the minutes of previous meetings.

2. Safety including the presence of hazardous materials and other environmental issues.

3. Quality Control Issues including outstanding non-conformance reports/ issues.
4. Review progress of the Work since last meeting, including status of submittals for approval.
5. Status of coordination and installation meetings with other prime and subcontractors engaged in the work of the project.
6. Identify problems which impede planned progress.
7. Develop corrective measures and procedures to regain planned schedule, if applicable.
8. The status of Requests for Information (RFI) and all Potential Change Orders (PCO) shall be discussed and updated. The Contractor’s PCO listing shall conform to SEPTA’s listing.
9. Contractor shall provide and discuss "30 day look-ahead" activity schedule if the work is not progressing per the early start/finish activity dates as noted in the latest update of the approved schedule.
10. Discuss and review As-Built Drawings/Specification Status.
11. Complete other current business.

C. Revisions to minutes:

1. Unless published minutes are challenged in writing, within five (5) working days of the distribution date they will be accepted as properly stating the activities and decisions made at the meeting.

2. Any individual challenging published minutes shall provide proper supporting documentation acceptable to the Project Manager to verify that the challenged item was truly discussed during the subject meeting.

3. Challenge to minutes shall be settled as priority portion of "old business" at the next regularly scheduled meeting. SEPTA's Project Manager decisions concerning challenged item(s) shall be binding on the Contractor.

END OF SECTION
SECTION 01300 - SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers all submittals, including shop drawing submittals, samples, manufacturer’s cut sheets, and “or equal” submittals. It complements the requirements of Paragraph VIII.N. of the Agreement.

B. Some products and procedures only require a submittal for information and may not require a response from SEPTA.

1. Products which match exactly something specified by manufacturer’s name and catalog model number.

C. SEPTA reserves the right to not formally respond to any submittal which is not required.

D. The Contractor may require subcontractors to provide drawings, installation diagrams, and similar information to help coordinate the Work, but such data shall not be reviewed by SEPTA unless it is required by other pertinent sections of the Specifications.

E. The contractor is required to submit all information in an electronic format as approved by the SEPTA PM.

F. In addition to any other documentation responsibility, the Contractor shall provide copies of all approved and/or incorporated submittals in an electronic format as defined by the SEPTA PM to fulfill Contract closeout requirements.

1.02 RELATED WORK:

A. Section 01010 - Summary of Work

B. Section 01011 - Summary of Project

C. Section 01041 - Project Coordination

D. Section 01400 - Quality Requirements

E. Section 01700 - Contract Closeout
1.03 SUBMITTAL PREPARATION

A. The Contractor, within two weeks of the receipt of the designer of record’s computerized listing of Contractor(s) submittals, shall review, revise and/or amend, if applicable, and resubmit the revised listing of submittals.

B. The contractor will assess material availability and all long lead items shall be identified.

C. After checking and verifying all field measurements and, after complying with the applicable procedures of the Contract, the Contractor shall submit shop drawings, catalog cuts, samples, and substitution(s) for review and action.

D. The Contractor shall be responsible for coordination between the Contractor/Fabricator/Detailer and SEPTA for each complex submittal requiring detailed coordination, including all structural items. This coordination may be executed in a meeting called at the request of the contractor or SEPTA. The purpose of the meeting(s) shall be to establish guidelines for details and information necessary to prepare the shop drawings.

E. All submittals will be sent directly to the SEPTA PM unless the PM specifically directs the contractor to do otherwise.

1.04 SUBMITTAL REVIEW

A. The results of review of submittals will be designated as follows:

   NO EXCEPTIONS TAKEN

   PROCEED AS NOTED;

   PROCEED AS NOTED; REVISE AND RESUBMIT

   DO NOT PROCEED; REVISE AND RESUBMIT

   REJECTED

   NOT APPLICABLE

B. Submittals not in compliance with the Contract will be returned to the Contractor for revision. Any losses of time and additional costs associated with resubmittal(s) are the Contractor’s responsibility.
C. Each submission and re-submission shall give specific written notice on the transmittal of each variation that the shop drawings or samples may have from the requirements of the Contract Documents and, in addition, shall cause a specific notation to be made on each shop drawing submitted for review and approval of each such variation.

D. Each resubmission(s) shall clearly identify and make specific notation(s) on each shop drawing concerning the:

1. Changes that are made as a result of comments on the previous submittal(s).

2. Changes that are not made, but commented on the previous submittal(s). The Contractor shall provide detailed explanations and justifications as to why the comments are not addressed.

3. Changes that are solely made by the Contractor, but were not commented on the previous submittal(s). The Contractor shall provide a detailed explanation and justification for such changes.

E. Submittals that are "Proceed as Noted" are for the purpose of expediting procurement/fabrication/Installation of the intended work. If re-submittal is required, the Contractor shall incorporate all corrections and resubmit original drawings and required copies of drawings to SEPTA, within 30 days. If re-submittal is not required, then it is understood that the Contractor will proceed in accordance with the comments.

For “Proceed as Noted; Revise & Resubmit” items, payment for completed work that is related to these items will not be made until the corrected and final resubmittal is accepted in writing by SEPTA.

1.05 QUALITY ASSURANCE

A. SEPTA reserves the right to require mock ups of any material and/or assembly, at any time during the construction process. Once approved, the mock-up will set a minimum standard of performance and/or appearance for the work. Mock-ups will be provided at no cost to SEPTA. The approved mock-up may, at the discretion of the SEPTA project manager become part of the work.

B. Electronic Submittals
1. SEPTA uses software to track submittals. The Contractor’s forms, e.g. transmittal etc., will be submitted in a form compatible with this software.

2. For its records, SEPTA requires that all approved submittals be converted to electronic format (at no additional cost to SEPTA) for SEPTA’s document retention purposes.

C. Coordination of Submittals:

1. Prior to making each submittal, the Contractor shall carefully review and coordinate all aspects of each item being submitted. Shop drawings of systems containing closely related items and components must be submitted, as a single submission showing the inter-relationship of the components required for that system.

2. The Contractor shall verify prior to submission that each shop drawing is well prepared and that the submittal conforms in all respects with the specified requirements. The drawings shall provide complete information regarding proper fabrication and installation.

3. The Contractor shall sign each submittal or shop drawing original and copies and affix a stamp with specific written indication that the Contractor has reviewed the submittal and is satisfied that it conforms to the requirements of the contract documents. For submittals which are substitutions see 1.05 below.

4. Shop drawings shall be tailored to the specific project need including coordination of various trades and should include material descriptions, quantities, dimensions, design criteria and similar data to enable review information as required. The shop drawings must show clear and complete information for the fabrication and installation of materials.

5. Where feasible, orient the plan(s) on the shop drawing(s) in the same manner as the plans on the Contract Drawings.

6. Shop drawings with reproduction(s) of the Contract Drawings will not be accepted.

7. Structural fabrication and erection drawings shall be prepared, checked, signed, and sealed, by a Professional Engineer licensed in the Commonwealth of Pennsylvania with proven qualifications and similar experience.
Unless the Contract Documents indicate specific steel connections, the Contractor shall design steel connections, stamped and sealed by an engineer licensed in the State of Pennsylvania, and provide sufficient details for the SEPTA’s review and approval.

D. Responsibility: The Contractor is solely responsible and accountable for:

1. Means, methods, techniques, sequences, and procedures of construction including fabrication, assembly, installation/erection, safety precautions, and programs incidental to any submittal.

2. Accuracy of all submittals and shop drawings and final installation.

3. Arranging submittals and shop drawing standards review meetings with SEPTA.

4. Converting all approved submittals to an agreed on electronic format (PDF unless otherwise noted) and providing these files to SEPTA at no cost to SEPTA.

1.06 SUBSTITUTIONS

A. "Or Equals" Substitutions:

1. Restricted Items (sole sourced items) – Where the contract documents specifically require the use of certain equipment and/or materials they will indicate that substitutions will not be allowed.

2. Equals Considered – Unless otherwise noted, whenever a material or article required is specified or shown on the plans by using the name of the proprietary product or of a particular manufacturer or vendor, any material or article with matching characteristics, will be considered equal and satisfactory provided the material or article has equal properties and function in the opinion of SEPTA’s Project Manager. It shall not be purchased or installed without SEPTA’s Project Manager’s written approval.

The Contractor shall document each request with complete data substantiating compliance of the proposed Substitution with the Contract Documents. "Or Equal" requests will be considered only when substantiated by the Contractor's submittal of data documenting the "or equal" nature of material or article within 35 calendar days after the date of receipt of Notice to Proceed. A request constitutes a representation that the Contractor:
a. Has investigated the proposed product and determined that it meets or exceeds the quality level of the specified product.

b. Shall provide the same warranty for the substitution as for the specified product.

c. Shall coordinate installation and make changes to other work, which may be required for the Work to be complete with no additional cost to SEPTA.

d. Shall waive claims for additional costs or time extension, which may subsequently become apparent.

e. Shall reimburse SEPTA (if applicable) for review or redesign services associated with review and approval by SEPTA, if the substitution is rejected as not being equivalent.

B. Other Substitutions

1. For any reason, including a lack of availability of the original material, the contractor may ask permission to substitute a material or assembly which is not fully equal to the one specified. This will be processed as a change order (a no cost change order only if there is no cost difference compared to the original specified material). All substitutions will be evaluated following Value Engineering principles. The results of SEPTA's evaluation will be final, and SEPTA is has the right to make a final determination over which items are judged to be acceptable.

The Contractor shall document each request with complete data substantiating compliance of proposed Substitution with Contract Documents. A request constitutes a representation that the Contractor:

a. Has investigated the proposed product and determined that it meets or exceeds the quality level of the specified product.

b. Shall provide the same warranty for the substitution as for the specified product.

c. Shall coordinate installation and make changes to other work, which may be required for the Work to be complete with no additional cost to SEPTA.

d. Shall waive claims for additional costs or time extension, which may subsequently become apparent.
2. The Contractor shall provide substitutions in a timely manner and in accordance with the construction contract, so as to not have a negative impact on the construction schedule.

PART 2 - PRODUCTS

2.01 SHOP (FABRICATION/INSTALLATION) DRAWINGS

A. Shop drawings shall be based on field dimensions and other information gathered by the contractor and his agents. When SEPTA or the designer of record takes no exceptions to the drawings or directs the contractor to proceed as noted, it is only claiming that there are no apparent deviations from the design intent of the contract documents.

B. Final fit and placement may be affected by fabrication and field installation tolerances as well as other factors beyond the knowledge of SEPTA and the designer of record. Installation and final fit remains the sole responsibility of the contractor. Language placing this responsibility on SEPTA or the designer of record is strictly prohibited.

C. Scale and measurements: Shop drawings shall be made accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work. SEPTA reserves the right to demand additional detail and information to facilitate the submittal process.

D. Required Copies:

1. Shop drawings shall be submitted in the form of 3 full-size copies of each sheet in a media acceptable to the SEPTA Project Manager.

E. Review comments will be shown on one set which will be returned to the Contractor. The Contractor may make and distribute such copies as are required for its purposes.

2.02 MANUFACTURERS' LITERATURE (INCLUDING CATALOG CUTS)

A. The Contractor shall submit the original printed literature and product data sheets available from the manufacturer(s) and 3 copies. SEPTA will keep the original copy of all items submitted.

B. Where submitted literature from manufacturers includes data not pertinent to the submittal, the Contractor shall clearly show which portions of the contents are being submitted for review.
C. The Contractor shall submit the copy which is to be returned, plus 3 copies for SEPTA's use and distribution.

2.03 SAMPLES

A. The Contractor shall provide sample(s) identical to the precise article proposed to be provided. Identify as described under "Identification of submittals" below.

B. Number of samples required:

1. Unless otherwise specified, the Contractor shall submit two samples, one of which will be retained by SEPTA.

2. By prearrangement in specific cases, a single sample may be submitted for review and, when approved, be installed in the Work at a location agreed upon by SEPTA.

2.04 COLORS AND PATTERNS

A. Unless waived in the specific section of the Contract Documents, whenever a choice of color or pattern is available in the specified products, the Contractor shall submit accurate color and pattern charts for selection.

B. SEPTA reserves the right to require samples and/or a mockup of any material, to determine actual appearance.

C. Unless waived elsewhere, two copies of each sign face in accurately color matched proofs of all permanent signage, at a scale specified by the SEPTA PM, will be submitted.

PART 3 - EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS

A. The Contractor shall assign a date and unique number to each submittal and an indication that the contractor has reviewed the submittal for conformance to the contract documents. This information shall appear on each submittal original and copy.

1. Each submittal subject to approval must receive a separate number not shared by any other component, information or process. Only one approval/rejection will be given per submittal number.
2. Each submittal number must include the specification section that the submittal most applies to followed by a hyphen and a sequential number (the first submittal for Section 05500 would be 05500-1 and so on).

3. When a resubmittal is made for any reason, the Contractor shall transmit under a new letter of transmittal with a new submittal number in the form of the original number plus the letters a, b, c and so on for each subsequent resubmittal (05500-1a using the above example) and a new date for that resubmittal.

B. The Contractor shall maintain an accurate submittal log for the duration of the Work, showing current status of all submittals at all times. The Contractor shall make the submittal log available for review by SEPTA upon request.

3.02 GROUPING OF SUBMITTALS

A. Unless otherwise specified, the Contractor shall make submittals in groups (with separate numbers) containing all associated items to assure that information is available for checking of each item when it is received.

B. Each grouping shall be accompanied by a dated transmittal letter which lists each transmittal by number and the number of copies submitted.

C. Partial, confusing, and poorly prepared submittals will be rejected as not complying with the requirements of the Contract. The Contractor will be liable for delays so occasioned.

3.03 TIMING OF SUBMITTALS

A. The Contractor shall make submittals consistent with early start dates shown on the approved baseline schedule, but sufficiently in advance of early scheduled dates for installation to provide the necessary time required for reviews, for securing necessary approvals, for possible revisions and resubmittals, and for placing orders and securing delivery.

B. In scheduling, the Contractor shall allow 14 calendar days for review and processing by SEPTA following its receipt of the submittal.

This review time will be increased for submittal(s) so extensive that 14 days of turnaround period is unreasonable as determined by SEPTA. This determination shall be binding on the Contractor.
C. Continued submission of material and repetitious submittals which clearly fail to meet the requirements of the Contract Documents which may cause delays in the completion of the Contract and any such delays be the sole responsibility of the Contractor.

3.04 SEPTA’S REVIEW

A. Review and Processing shall not relieve the Contractor from responsibility for errors, which may exist in the submitted data.

B. SEPTA does not confirm dimensions or make any representation that parts will fit together properly if fabricated in the sizes shown on the shop drawings. SEPTA requires that the contractor take all necessary site measurements and that the shop drawings represent an accurate documentation of these dimensions.

C. The contractor assumes responsibility to exercise control over all construction tolerances and ensure that these tolerances do not result in construction which violates regulations, codes, or clearances.

D. Revisions:

1. The Contractor shall make required revisions as noted on initial the submittal.

2. If the Contractor considers any required revision to be a change, it shall so notify SEPTA as provided for in the Agreement. Such notification shall be made no later than 10 calendar days from the date of return of such submittals by SEPTA to the Contractor.

3.05 SHOP DRAWING AND SUBMITTAL CONFLICTS WITH THE CONTRACT DOCUMENTS

A. Unless the Contractor submits data as a substitution as specified in section 1.05 above, submitted information which departs from the contract documents will be understood to be contractor/subcontractor errors and have no effect on the contract, even if not identified by SEPTA during the review process.

3.06 FINAL ELECTRONIC SUBMISSION

A. As part of the Contractor’s Closeout Documentation requirements, the Contractor shall submit to the SEPTA PM all approved submittals and
other documentation in an electronic format (PDFs unless otherwise approved by the SEPTA PM).

END OF SECTION
SECTION 01305 - REQUESTS FOR INFORMATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section stipulates procedural requirements for processing of Contractor Request(s) for Information (RFI) and complements the requirements of the Contract Agreement, Paragraphs V.B and VIII.B.

B. An RFI is a written communication originated by a construction Contractor to request clarification of the intent of the Construction documents. It results in an exchange of information only. If the contractor believes the response triggers a change in the project scope he must submit a change order request. No response to an RFI may be interpreted as a change order request or approval.

1.02 RELATED WORK

A. Agreement
B. Section 01010 – Summary of Work
C. Section 01011 - Summary of Project
D. Section 01041 - Project Coordination
E. Section 01300 - Submittals
F. Section 01400 - Quality Requirements
G. Section 01700 - Contract Closeout
H. Section 01720 – Project As-Built Documents
I. Attachment - Request for Information Form

1.03 SUBMITTALS

A. The Contractor shall comply with the provisions of Section 01300.

B. The Contractor shall submit RFIs using the attached RFI form and shall provide specific reference to the section of the Construction documents to which the RFI refers. RFIs that are incomplete, unsigned or otherwise not submitted in compliance with the Contract, will be returned to the Contractor.
C. Any losses of time and/or additional costs associated with frivolous RFI submittals are the responsibility of the Contractor.

1.04 QUALITY ASSURANCE

A. All RFIs will be signed by the Contractor’s representative and submitted to SEPTA in "hard" copy.

B. The primary purpose of an RFI is to clarify the Contract Documents

1. The Contractor has the responsibility to be familiar with the Contract documents. RFIs that request clarification of items that in the judgment of the PM, are clearly evident in the Contract documents, shall be rejected by SEPTA.

2. The Contractor shall not use RFIs for the following:

   a. To facilitate construction coordination between contractors and subcontractors/vendors.

   b. To initiate substitutions in material, methods and or systems.

   c. To transfer their responsibility for reviewing Contract documents to SEPTA and/or the Architect/Engineer.

3. RFI’s, which fail to reference the specific Contract documents in question, will be rejected. If the Contractor uses an RFI for the purposes described above in 1.04 B2 it will also be rejected. In these cases, the Contractor will be directed to meet the requirements specified in Section 01300 by the PM.

PART 2 – PRODUCTS

   NOT USED

PART 3 - EXECUTION

3.01 IDENTIFICATION OF REQUEST(S) FOR INFORMATION

The Contractor shall consecutively number all RFIs. For projects with separate contracts, each Contractor shall include a prefix (G, E, M, etc.) in their numbering sequence to designate the submittal as originating from the
"General," Electrical," or "Mechanical" Contractor. RFIs shall be submitted using the attached form. When an RFI must be resubmitted for any reason it shall be sent using a new RFI number with reference provided to the previous RFI.

3.02 TIMING OF REQUEST(S) FOR INFORMATION

A. The Contractor shall submit RFIs sufficiently in advance of early construction schedule “Start” dates for fabrication and/or installation activities in order to provide the necessary time required for reviews, possible revisions, and subsequent resubmittals.

B. For scheduling purposes, the Contractor shall allow 14 days for review and response by the Architect/Engineer and/or SEPTA following their receipt of the RFI.

This review time will be increased for RFIs that are sufficiently extensive or complex that the above turnaround period is unreasonable as determined by the Architect/Engineer and SEPTA. This determination shall be binding on the Contractor.

C. The Contractor shall be solely responsible for delays in the completion of the Contract that result from the submission of RFIs which clearly fail to meet the requirements of this Section.

3.03 SEPTA’S REVIEW

A. All RFIs will be submitted to the SEPTA PM. The designer of record is responsible for reviewing Contractors' RFIs to provide clarifications and/or interpretations as they relate to design documents. The SEPTA PM is responsible to provide clarifications and/or interpretations to RFIs that are related to the Agreement or SEPTA operational issues and service. An answer to a RFI shall never be considered as an approval for extra work and/or a change in scope or any other directive which results in a change to the Construction Contract cost. All such changes must follow the change order process.

B. If the Contractor considers any clarifications to an RFI to be a change; it shall so notify SEPTA in the manner provided for in the Agreement.

C. Such notification shall be made no later than 7 calendar days from the date of the return of such clarifications by the designer of record or SEPTA to the Contractor.
# REQUEST FOR INFORMATION (RFI)

**PROJECT:**

<table>
<thead>
<tr>
<th>1. RFI Number</th>
<th>Responsible Contractor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td></td>
<td></td>
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</table>

Requested By (Signature):

<table>
<thead>
<tr>
<th>2. A/E Response, or SEPTA Comments (if applicable):</th>
</tr>
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</table>

A/E (Signature):

<table>
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<tr>
<th>Date</th>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Contract Document Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes No Revisions Attached No</td>
</tr>
<tr>
<td>Yes No</td>
</tr>
</tbody>
</table>

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<tr>
<th>3. Transmitted to Contractor</th>
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</table>

CD&C PM (Signature):

<table>
<thead>
<tr>
<th>Date</th>
</tr>
</thead>
</table>

4. PCO

Yes No Impact

PCO Number: 01305-5

Requests For Information
Filling out the RFI Form

01: This section is to be completed by the Contractor. The SEPTA Project Manager (PM) shall provide RFI Forms to the Contractor(s) at the Pre-construction Meeting.

02: This section is to be completed by the A/E. All technical inquiries are to be responded to by the A/E. The section must be signed and dated within the contractual time frame. The SEPTA PM may use this space to add comments or directly respond to non-technical queries, involving contractual matters or SEPTA Operational issues.

03: This section is to be completed by SEPTA project staff to return the RFI to Contractor. The distribution must include the Project File.

04: This section is to be completed by SEPTA project staff. The RFI response will be reviewed for its potential to result in a Change Order. This box should be appropriately completed as a result of this review.
SECTION 01380 - CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall provide professional quality construction record photographs periodically during course of the Work as determined by the SEPTA PM. The contractor shall also provide professional quality record photographs of existing conditions prior to the start of construction.

B. In addition to photographs generally describing the progress of the work, the SEPTA PM will require specific components and processes be documented.

C. SEPTA reserves the right to require that an approved professional photographer be used if, in the opinion of the SEPTA PM, the photographs submitted at any time are inadequate in quality or coverage.

D. Photographs shall be taken bi-weekly at a minimum.

1.02 RELATED WORK

A. Section 01010 - Summary of Work

B. Section 01011 - Summary of Project

C. Section 01720 - Project Record Documents

1.03 PHOTOGRAPHY REQUIRED

A. The Contractor shall provide SEPTA with the photographs taken. Photographs shall only be used for the purpose of fulfilling the requirements of this section. Other uses are prohibited without written permission from SEPTA’s Project Manager. The Contractor may not take photographs for any other purpose on SEPTA property without the written consent of SEPTA.

B. Views and Quantities Required:

1. As specified above, the Contractor shall photograph the project from 10 different views on a bi-weekly basis, as directed by SEPTA.

2. As specified above, the Contractor shall photograph the existing conditions of project from 20 different views, immediately prior to
the start of construction. Additional views may be required as directed by SEPTA.

3. The Contractor shall provide 2 prints of each view, enclosed in 2 separate binders with double-faced plastic sleeves.

D. Ownership of Electronic Files

1. The prints and electronic files shall be furnished to SEPTA at the Contractor’s expense and all images collected during the course of the contract shall become the sole property of SEPTA. The contractor shall turn over all copyright rights to SEPTA in a written document to be approved by SEPTA.

PART 2 - PRODUCTS

2.01 PRINTS

A. Prints shall be provided in glossy finish, color, date encoded of sufficient quality to render detail in a satisfactory manner as determined by the SEPTA PM.

1. Size: 8 X 10 in. or as directed by the SEPTA PM.

B. The Contractor shall identify each print on back, listing:

1. Southeastern Pennsylvania Transportation Authority
2. FTA Project Number
3. SEPTA Project Number *(if applicable)*
4. Project Name
5. Bi-weekly progress photographs
6. Date: _______________________
7. Description/Key Plan
   a. Orientation of view
   b. Date and time of exposure
   c. Key plan in lower right hand corner permanently affixed.
8. Name and address of photographer.
PART 3 - EXECUTION

3.01 TECHNIQUE

A. Paramount importance shall be given to factual detailed presentation with maximum depth of field, proper exposure with adequate shadow and highlight detail and minimum distortion.

B. The photographer will be required to use fill in electronic flash technique to adequately light high contrast scenes and assemblies. Electronic flash shall also be used at all interior locations and other locations where the available light is not adequate for recording appropriate detail.

C. Camera capture (non-enhanced) must provide a minimum image size of 3500 x 2500 pixels unless otherwise determined by the SEPTA PM.

D. Take views as directed and in the presence of SEPTA's representative.

3.02 DELIVERY OF PRINTS AND FINAL DELIVERY OF ELECTRONIC FILES

A. The Contractor shall deliver two sets of prints and JPG files of adequate quality as determined by the SEPTA PM with each Application for Payment.

B. At the conclusion of the project, the contractor will provide a complete set of all electronic files delivered in a medium as directed by the SEPTA PM.

END OF SECTION
SECTION 01400 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Each Prime Contractor shall establish and maintain a project specific Quality Assurance/Quality Control (QA/QC) system documented by a program manual and supporting plans and/or procedures. These documents will address the methods to be used to control the quality-related aspects of all materials, components, and assemblies to be furnished and installed under the Contract Documents.

B. Each Prime Contractor shall have the primary responsibility for the quality of all its work and shall ensure that the pertinent requirements for the achievement of quality are included and implemented in all relevant subcontracts.

C. The QA/QC program shall include a description of the organization the contractor will establish and shall identify the responsibilities and accountabilities of all personnel performing quality-affecting activities.

D. The QA/QC program and/or procedures shall include those checklists and test and inspection forms the contractor will use to properly document the activities performed to achieve the quality of the Work. Each Prime Contractor will be responsible for completing the checklists and activities called for in SEPTA’s Construction Inspection/Monitoring Program as part of their Quality Control program.

E. Each Prime Contractor will cooperate fully with SEPTA’s QA/QC efforts including, but not limited to, providing requested information in a timely fashion when SEPTA executes quality audits of the project. All information generated during the project, of a non-confidential nature, including but not limited to the internal QA/QC audits executed by the contractor must be made available to SEPTA in a timely manner.

1.02 DEFINITIONS

A. The Following definitions pertain to requirements of this section.

1. Quality Assurance (QA): QA is a program of planned and systematic actions that provide adequate confidence that all activities affecting quality have been accomplished in accordance with governing codes, standards, and contract requirements. QA
oversight of activities affecting quality is accomplished through field and manufacturing facility surveillance, audits or other documented measures conducted to verify that requirements have been met.

2. Quality Control (QC): Quality Control is the act of examining, witnessing, inspecting, checking and/or testing of in-process or completed work to determine conformity with specified requirements and documenting the results.

3. QA Audit: A documented activity performed by written procedure or checklist to verify that selected elements of the Quality Assurance/Quality Control Program have been developed, documented, and implemented in accordance with specified requirements.

4. Calibration: Comparison of two instruments or measuring devices, one of which is of known accuracy traceable to national standards, to detect, correlate, report or eliminate by adjustment any discrepancy in the accuracy of the instrument or measuring device being compared with the standard.

5. Certification: The action of determining, verifying, and attesting, in writing, to the qualifications of personnel, materials, and/or equipment.

6. Inspection: A phase of Quality Control, which by means of examination, observation, or measurement, determines the conformance of materials, components, parts, appurtenances, systems, processes, installations, or structures to predetermined quality requirements.

7. Source Inspection: Source inspection consists of the review, monitoring, observation, and/or inspection, random or consistent, or at selected stages of manufacture or construction, of manufacturer or sub-manufacturer’s personnel, material, equipment, processes, or tests.

8. Site Inspection: Site Inspection consists of reviewing, monitoring, observing and inspecting the Work at the project site.

9. Surveillance: Term used to describe a review performed for the purpose of verifying that applicable quality requirements are properly accomplished.

1.03 RELATED WORK
A. Requirements of the Agreement.

B. Section 1410: Testing and Inspection Services

C. Section 01700: Contract Closeout.

D. Specific requirements of Agreement Paragraph XVIII.

1.04 SUBMITTALS

A. SEPTA reserves the right to require mock-ups of any material and/or assembly, at any time during the construction process of a size determined by the SEPTA PM. Once approved, the mock-up will set a minimum standard of performance and/or appearance for the work. Mock-ups will be provided at no cost to SEPTA. The approved mock-up may, at the discretion of the SEPTA project manager, become part of the work.

B. The contractor will create a job specific Quality Assurance and Control Plan (QACP) which clearly and comprehensively specifies the actions the contractor will take to achieve the quality required by the contract documents. This plan will be submitted no later than 15 days from the notice to proceed. No work may take until the QACP has been accepted by SEPTA. The following areas will be addressed in this plan:

1. The Quality Assurance procedures shall define the organizational structure within which the programs are to be implemented, and delineate the responsibility and authority of the various personnel involved.

2. Shop Fabrication: The Contractor shall develop and submit inspection and test plans and procedures for all elements of the work that will be shop fabricated and tested. The inspection plans/procedures shall include source inspection and testing that will be performed, accept/reject criteria and the witness/hold points to be implemented to control the quality of work.

3. Site Construction/Installation: The Contractor shall develop and explain inspection and test plans and procedures for all elements of the Work that will be site constructed and installed, including the storage and installation of shop fabricated items. The installation plans and procedures shall include checklists, which outline the sequence of construction/installation activities and describe the verification checks for each step in the sequence, which must be found acceptable prior to proceeding. The plans and checklists shall be submitted to SEPTA for the identification of hold and/or witness points by SEPTA.
4. The Contractor shall develop and explain a Quality Assurance program and surveillance methods to verify that reviewed inspection, testing and documentation activities have been performed to assure that shop fabricated and site construction/installation comply with the quality standards defined in the contract documents.

5. SEPTA’s review of the QA/QC program shall not relieve the Contractor from its primary responsibility for the quality of the work.

1.05 QUALITY ASSURANCE RESPONSIBILITIES OF THE CONTRACTOR

A. Engage an adequate number of skilled professionals who are thoroughly trained, experienced, and familiar with the specific requirements and methods needed for the proper performance of the Work.

B. Establish technical and administrative surveillance and/or audit methods to ensure the highest degree of quality, and to correct potential problems without affecting the Contract schedule.

C. Verify that the required quality control inspection, testing, and documentation activities have been performed to assure that the equipment, materials, and construction comply with the requirements of the contract documents in all respects.

D. Monitor quality control over suppliers, manufacturers, fabricators, products, services, site conditions, workmanship, and installation to produce work of the quality required by the contract documents.

E. Take corrective actions in a timely manner to identify conditions adversely affecting the quality of Work and the contract schedule.

F. All test results shall clearly include a statement that the item tested or analyzed conforms or fails to conform to the contract requirements. Each report shall be conspicuously stamped on the cover sheet in large red letters a minimum of ½-inch-high "CONFORMS" or "DOES NOT CONFORM" to the Specifications as the case may be.

G. All test reports shall be signed by a testing laboratory’s authorized person and counter signed by the Contractor. The testing agency shall provide all tests, reports, certifications and other documentation sent directly to the SEPTA PM at the same time results are made available to the Contractor.

H. The quality assurance functions shall include, but not be limited to.

   · Contract Review
   · Factory and Field Testing
· Document Control · Handling and Storage
· Procurement · Packaging and Shipping
· Shop Fabrication · Quality Records
· Field Fabrication · Non Conformance Reporting
· Field Installation · Corrective Action (s)
· Field Assembly · QA Audits
· Receiving Inspections · Training
· Final Inspection · Control of In Process Activities
· In process inspections · Identification and Traceability

I. The Contractor shall promptly reject work, which does not comply with the requirements of the contract documents. If the contractor elects to propose that SEPTA accept work that is nonconforming, the contractor shall reimburse SEPTA for the costs associated with the review of the nonconforming work by the designer of record.

J. Develop quality assurance forms in a format acceptable to SEPTA for all major elements of the Work including any additional elements

K. The Contractor shall perform audits periodically, no less than four times a year, to maintain level of quality. The results of these audits must be documented and shown to SEPTA on request.

1.06 SOURCE QUALITY CONTROL RESPONSIBILITIES OF CONTRACTOR

A. Document that each material, manufactured product and fabricated item is produced and tested to comply with quality standards required by the contract documents. The Contractor shall perform audits periodically, no less than four times a year, to maintain level of quality.

B. Do not deliver material, manufactured product, or fabricated item until certified quality assurance documents are satisfactorily reviewed by SEPTA.

C. Do not schedule any factory tests/inspections by SEPTA until these documents are satisfactorily reviewed by SEPTA. Twenty-one (21) day’s prior written notice is mandatory for (re) scheduling any factory tests or inspections by SEPTA.

D. SEPTA reserves the right to source inspect the material, manufactured product or fabricated item after acceptance of the certified quality assurance documents. Any and all costs related to reinspection(s) by SEPTA shall be the responsibility of the Contractor.
E. The quality assurance documents shall identify any changes made to the material, manufactured product or fabricated item as compared to the Contract requirements and approved shop drawings. The Contractor shall describe as to how each change will affect the installation, space and subsequent operations.

F. SEPTA's review of quality assurance documents and inspections shall not relieve the Contractor from its "primary" responsibility for the quality of work.

1.07 CONTRACTOR QUALITY MANAGER (QM)

A. The Contractor shall identify an individual (QM) within its organization at the site of the Work, who shall be responsible for overall management of Contractor's Quality Assurance/Quality Control (CQC) system. An individual who has no other duties shall fill the function of the QM.

1. The QM shall be experienced in the performance and supervision of the inspections and tests required by the specifications.

2. The QM shall be on the work site at all times that work is taking place and have complete authority to take any action necessary to ensure conformance with the Contract.

3. The QM will be the point-of-contact for all quality matters. The QM is expected to represent the Contractor with respect to all QA audit and review activities performed on the Contractor by outside parties.

4. The QM shall be appointed by letter and may not be replaced without written permission from SEPTA.

5. The QM may take daily direction from the Contractors Superintendent however unless prohibited by organizational size the QM shall independently report to an official within the Contractor's organization who is separate from direct responsibility for the outcome of the project.

6. The QM shall be responsible for the documented incoming inspection and determination of acceptability in conformance with Contract requirements of all material arriving at site.

7. Receiving inspection(s) shall include the review of associated documentation where necessary to verify the compliance of the item. Segregate and remove from the site, any nonconforming material.
1.08 SITE QUALITY CONTROL RESPONSIBILITIES OF CONTRACTOR

A. Unless otherwise specially allowed elsewhere in the contract, do not deliver reconditioned material to site. Protect all stenciled markings, labels and any other type of identification(s) to clearly identify the originality of the material.

B. As soon as the material arrives at site, (but before beginning installation) provide to SEPTA the original Bill of Lading and Certification that the material complies with the requirements of the contract documents.

C. Installation shall comply with approved shop drawings. Do not begin installation until relevant installation shop drawings have been appropriately reviewed by SEPTA. If for any reason the material or component cannot be installed according to the approved shop drawing and the installation instructions provided by the manufacturer/fabricator the contractor is to alert the SEPTA immediately and not begin installation without concurrence from the SEPTA PM.

D. Perform necessary and specified tests and document the results. Replace material that fails the tests at no cost to SEPTA.

E. Remove and replace material that is damaged in storage or in the performance of Work unless specifically accepted in writing by SEPTA's Project Manager.

F. No Work shall be performed at the site if the Contractor’s Superintendent or his authorized representative, as approved by SEPTA, is not present at the location where Work is being performed.

1.09 NON-CONFORMANCE REPORTS

A. A non-conformance report (NCR) shall be issued when any material or component does not meet the requirements of the contract documents in the opinion of the SEPTA Project Manager or other approved SEPTA personnel.

B. Once issued, the contractor has ten (10) days to challenge the NCR in a written response to the SEPTA PM.

C. Any NCR not withdrawn in writing by the SEPTA PM or other approved SEPTA personnel, must be corrected in a timely manner.

D. The contractor is obliged not to proceed with any work which would cover or reduce access to the non-conforming work.
1.10 CONSTRUCTION INSPECTION AND MONITORING PROGRAM

A. The contractor will be required to complete checklists, usually in the presence of a member of the SEPTA project team, at specific critical points of the project’s execution to verify quality assurance procedures. SEPTA reserves the right to provide these checklists and require their completion in a timely manner without prior notification.

1.11 SUGGESTED CONTENTS OF A QA/QC PLAN

The contractor’s inspection and testing plan must be specific and not generic; tailored to the actual requirements of the project. Most plans will include many of the following items:

A. Organization & Responsibilities

1. Provide an organizational chart showing who has responsibility for quality control functions and how they interact with the rest of the project team. The QA/QC team must report directly to upper management and not to the project manager overseeing day-to-day activities of the project.

2. Supply brief resumes of key personnel

3. Document how the QA/QC personnel will oversee the QA/QC activities subcontractors and fabricators.

B. Procedures and Documentation

1. Samples of logs and checklists to be used in QA/QC activities.

2. A schedule of tests, inspections and mock-ups required by the contract documents and governmental authorities

3. Procedures which guarantee that any material which must meet a specific test or other definition of quality is delivered to the job site accompanied by written verification that the material does meet these requirements. Included in this procedure is the process of gathering this information and retaining it by the contractor.

4. Procedures which insure that handling and storage instructions are obtained and followed for all material.

5. Procedures that insure that the contractor effectively controls documents at the job site. Included in this responsibility is a requirement that a copy of the most current construction documents is present at the job site at all times; including but not limited to
drawings, specifications, addendum items, change orders and RFI's.

C. Inspection and Testing Activities

1. List of inspection devices to be used by the contractor or a subcontractor which must be calibrated, the proposed frequency of calibration and who will calibrate them.

2. Procedures to ensure that testing and inspections will be done in a timely manner and will not negatively impact the progress of the work.

3. Procedures to insure that mockups and pre-installation conferences are done in a timely manner and give the SEPTA PM sufficient time to participate and review them without negatively impacting the schedule.

4. Procedures that insure that material which fail tests or inspections is identified and segregated.

D. Audit Activities

1. Define how and how often the QA/QC efforts for key construction activities will be audited and how the results of this audit will be presented to the job superintendent.

2. Define when anticipated audits may be implemented.

END OF SECTION
SECTION 01410 - TESTING AND INSPECTION SERVICES

PART I GENERAL

1.01 DESCRIPTION

A. The Contractor shall employ an independent testing and inspection agency fully licensed and competent in the field of testing and inspecting specific elements of the project. The Contractor shall submit all testing agencies and their qualifications for SEPTA's prior written approval before any testing begins.

B. The Contractor shall pay for all necessary testing and inspection services, except as noted in D below.

C. It shall be the independent testing and inspection agency’s responsibility to implement, document, and report on the special inspections program as required by the International Building Code (IBC).

D. In addition to the requirements of the special inspections program required by the IBC, all testing and inspection identified in these specifications is to be performed. This includes but is not limited to weld inspections, bolt inspections, soil compaction testing, concrete strength testing, rebar inspections, and paint inspections.

1.02 RELATED WORK

A. Agreement

B. Section 01400: Quality Requirements

C. Section 01600: Material and Equipment

1.03 REFERENCES

A. ASTM International (ASTM).

1.04 SUBMITTALS

A. Prior to start of Work, submit testing and inspection agency name, address, and telephone number, and names of full-time registered Engineers and responsible officer.
B. Submit copy of report of the agency’s laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

C. Identify all required activities which the Testing and Inspection Agency shall perform on this project and include these agency activities in the Contractor(s) own schedule of work to be provided.

D. Reports:

1. After each inspection and test, the testing agency must promptly submit two (2) copies of results directly to the SEPTA PM and to contractor.

2. Include:
   a. Date issued,
   b. Project title and number,
   c. Name of inspector,
   d. Date and time of sampling or inspection,
   e. Identification of product and specifications section,
   f. Location in the Project,
   g. Type of inspection or test,
   h. Date of test or inspection,
   i. Results of tests or inspection,
   j. A statement of Conformance or Non-Conformance with the Contract Documents.

3. When requested by SEPTA, provide a written clarification and interpretation of test/inspection results.

1.05 QUALITY ASSURANCE

A. The testing and inspection agency shall be approved by SEPTA.

B. The Laboratory shall comply with requirements of all appropriate ASTM International (ASTM) or other standard as required by the specification.
C. Laboratory: Authorized to operate in the Commonwealth of Pennsylvania.

D. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.

E. Testing Equipment: All equipment must be calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants defined by industry standards.

F. Testing, when required, shall be the strictest of all pertinent codes and regulations, including selected ASTM International.

G. All site testing and taking of specimens and samples shall be performed in the presence of the Contractor’s Superintendent and the SEPTA PM unless the PM waives the right to be present, in writing.

H. No testing required by the contract documents or common industry practice may be waived or altered without the written permission of SEPTA’s Senior Director of Capital Construction or SEPTA’s Chief Engineer.

1.06 PRODUCT HANDLING

A. The Contractor shall comply with pertinent provisions of Section 01600.

B. The Contractor shall promptly process and submit required copies of test reports and related instructions to assure necessary retesting and replacement of materials without any possible delay in the progress of the Work.

1.07 CONTRACTOR’S RESPONSIBILITIES

A. Representatives of the testing and inspection agency shall have access to the Work at all times and at all site and off site locations, including manufacturing and fabrication facilities. The Contractor shall provide whatever support is required to enable the agency to perform its functions properly.

B. By advance discussion with the testing agency, the Contractor shall determine the schedule required for the agency to perform its tests and
inspections and to issue each of its findings. The contractor is solely responsible for any delays caused by testing and inspection services.

C. The Contractor shall provide all required testing and inspection time within the approved construction schedule.

D. Deliver to agency at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.

E. Provide incidental labor and facilities:
   1. to provide access to Work to be tested or inspected,
   2. to obtain and handle samples at the site or at source of Products to be tested,
   3. to facilitate tests and inspections,
   4. to provide storage and curing of test samples.

F. Notify the SEPTA PM 48 hours prior to expected time for operations requiring inspecting and testing services.

G. When initial tests indicate non-compliance with the Contract Documents, subsequent retesting occasioned by the non-compliance shall be performed by the same testing agency, at no additional cost to SEPTA.

H. Inspecting and testing performed exclusively for the Contractor's convenience shall be the sole responsibility of the Contractor.

END OF SECTION
SECTION 01500 - CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. General Contractor shall provide temporary facilities and controls needed for the performance of its Work (except otherwise noted), provide for public and employee safety and protect SEPTA property. This may include, but is not necessarily limited to:

1. Temporary utilities such as heat, water, electricity, and telephone;
2. Field office for the Contractor’s personnel and a separate facility for SEPTA’s personnel use
3. Sanitary facilities
4. Enclosures such as tarpaulins, barricades, and canopies;
5. First-aid facilities
6. Temporary fencing and other safety devices for pedestrian and vehicular traffic as well as isolating the construction area.
7. Entry Control
8. Personnel Identification
9. Guard Service

1.02 RELATED WORK

A. Agreement
B. Section 01010: Summary of Work
C. Section 01011: Summary of Project
D. Section 01041: Project Coordination
E. Section 01060: Regulatory Requirements and Safety
F. Section 01590: SEPTA Field Office
1.03 SUBMITTALS

A. The Contractor shall comply with pertinent provisions of Section 01300.

B. If required by the SEPTA PM, the Contractor shall provide shop drawings (including sealed engineering drawings if requested) for any temporary facility.

1.04 PRODUCT HANDLING

A. The Contractor shall maintain and protect all temporary facilities and controls in proper and safe condition throughout progress of the Work. For facilities visible to the public, the contractor will maintain them in an acceptable appearance and repair any vandalism within 24 hours or as requested by the SEPTA PM.

1.05 TEMPORARY UTILITIES AND SERVICES

A. Water

1. The Contractor shall provide drinking water from an approved source, so piped or transported as to keep it safe and fresh and served from single service containers or satisfactory types of drinking stands or fountains. All such facilities and services shall be furnished in strict accordance with existing governing health regulations.

2. Refer to the Agreement, Paragraph VIII.D. The Contractor shall protect pipes from freezing during inclement weather and repair any vandalism.

B. Sanitary facilities:

1. Refer to the Agreement Paragraph VIII.D.

2. The contractor is prohibited from using existing toilet facilities – either those intended for SEPTA personnel or those intended for the public at large.

3. The Contractor shall furnish for the work force on this project, the necessary toilets, secluded from public observation. The toilets shall be kept in a clean, sanitary condition and shall comply with the requirements and regulations of the agencies having jurisdiction. The SEPTA PM must approve all toilet locations and may demand increased maintenance if he finds the level of maintenance unacceptable.
C. Power and Lighting:

1. The Contractor shall provide, maintain, and pay for all costs of temporary electrical and lighting services required at the site for the proper performance and inspection of work. The level of lighting shall not be less than the existing. Lighting shall also be provided to all temporary public facilities at levels satisfactory to the SEPTA PM. Remove services and lighting after completion of work and repair of all damages.

2. The Contractor shall provide area distribution boxes so located that the individual trades, prime/subcontractors may furnish and use 100 ft. maximum length extension cords to obtain power and lighting at points where needed for work, inspection, and safety.

3. The Contractor shall provide all necessary items such as breakers, transformers, panel boards, and cable required for the service. The Contractor shall provide a complete distribution system expanded as required during the construction including wiring devices, outlets, distribution panels, transformers, cable, and other related work necessary to provide a temporary power system for use during construction.

4. The Contractor shall pay all costs associated with the utility tie-ins, physical plant, maintenance of system throughout construction, removal of same at project completion and any other items necessary in providing temporary power and light.

5. The temporary power and lighting system shall at all times conform to the applicable codes and regulations of OSHA, NEMA, UL, and the local municipality.

D. Telephones: The Contractor shall make necessary arrangements and pay costs for installation, maintenance, and operation of direct line (non-pay type) telephone services in SEPTA's field office at the site. Portable (cellular) may be provided to fulfill this requirement at the SEPTA PM discretion.

E. Heating and Air Conditioning: The Contractor shall provide and maintain heat and air conditioning necessary for proper conduct of operations.
1.06 ACCESS, STORAGE, AND PARKING AREAS

A. The General Contractor shall establish a construction compound in which the Coordinating Contractor provided SEPTA office trailers will be located adjacent to the Coordinating Contractor's office trailers. The physical location of the compound will require written approval of SEPTA's Project Manager.

B. The Contractor shall provide a minimum of 8 parking spaces adjacent to the SEPTA trailers within the compound for SEPTA/AMTRAK vehicles.

C. The Contractor shall provide all necessary security for this compound area. The Contractor shall provide all necessary keys to SEPTA's Project Manager to provide access to the compound at any time.

D. The Contractor shall submit to the Project Manager a plan layout of the Compound within 10 days after Notice to Proceed (NTP).

E. The Contractor shall coordinate the provision of utility services for all trailers and be responsible for all installation charges, removal costs at Project completion, and any periodic or other charges incidental to the provision of those utility services.

F. Upon final acceptance of the Work, the Contractor shall clean up the work areas and leave them in a neat and orderly condition. The Contractor shall dismantle and remove all temporary fencing and barricades and other temporary items installed, unless otherwise directed by the Project Manager. Repair damaged areas to their original condition.

1.07 FIELD OFFICES AND SHEDS

A. Contractor's Field Office:

1. Furnish and maintain a field office with a telephone at the site during the entire period of construction. The Contractor's superintendent shall be present at said office at all times while its work is in progress. Keep readily accessible, at the field office, copies of both the Contract Documents and the latest approved shop and working drawings.

2. Submit working drawings showing proposed locations and size of offices and shops for SEPTA's written acceptance.
B. Field Office Security

The Contractor shall Guard against unauthorized or illegal entry and protect the field office against vandalism, theft and mischief. The Contractor shall be responsible for the replacement and/or compensation for any items owned by SEPTA or SEPTA employees, which are related to the subject work, which are removed or damaged as the result of vandalism, theft, mischief, or illegal entry to the field office.

C. Upon project completion, the Contractor shall assume ownership of and remove temporary field offices and appurtenances from the job site, except as otherwise noted.

1.08 TEMPORARY BARRICADES, ENCLOSURES, AND FENCING

A. The Contractor shall provide all temporary barricades required by the phasing plans and specifications or otherwise necessary for the safe execution of the project, including but not limited to barricades for designated contractor work areas, contractor laydown areas, and public access for areas that must remain open during a phase.

1. Where barricades are required outside a designated work area for the exclusive use of a Contractor, that Contractor shall provide them.

2. SEPTA reserves the right to require the contractor to provide all necessary barricades to insure the safety of SEPTA personnel and passengers as determined by the SEPTA PM, whose decision shall be final.

B. The temporary barricades shall be of a design as shown on the drawings.

1. Barricades shall enclose and prevent entry into the work area and shall be full height and dustproof.

2. Barricades shall be constructed of materials suitable for location.

a. At open locations in unconfined spaces - Wood construction shall conform to the AFPA “National Design Specification for Wood Construction,” the latest edition. As a minimum, the barricades shall be constructed of 5/8 “thick APA rated exterior grade plywood. Framing members shall be Spruce- Pine-Fir No. 2 or better, a minimum of 2” x 4” and larger
sizes as necessary, spaced at a maximum 16” on center to provide a rigid temporary structure to resist all applicable loads.

b. All barriers in confined spaces, as determined by the SEPTA PM, must be constructed to not contribute smoke to or support flame spread of a fire. To achieve this, such barriers shall be built of metal studs and Wonderboard style cement board. The contractor may submit alternative designs for the construction of fire- and smoke-resistant structures subject to the approval of the SEPTA PM.

3. Barricades shall be painted on all solid surfaces exposed to public view. The paint shall be fire retardant when used on barricades in confined spaces.

4. Traffic cones, tape, stakes with ribbons, or other insubstantial items shall not be used to differentiate construction areas in lieu of barricades. At his sole discretion, the SEPTA project manager may make exceptions for work of extremely short duration.

C. Temporary Doors: The temporary barricades shall have hollow metal doors and frames, with locksets, at locations acceptable to SEPTA. The locksets on the doors requiring SEPTA access for operational and safety reasons shall be keyed to SEPTA’s standard lock system.

D. On a daily basis, the Contractor shall maintain the temporary barricades in a “like new” condition. The Contractor shall remove graffiti and restore surfaces on a continual maintenance basis. Maintenance shall continue until the barricades are removed.

E. The Contractor is required to enclose areas required by SEPTA for access and maintenance. If these areas are in public areas they shall be secured with temporary barricades and doors in accordance to 1.08 C and D above. The Contractor shall take all means to alleviate any or all tripping and falling hazards both within the work site but also in public areas. Areas where the general public or passengers may fall shall be secure and covered.

1.09 TEMPORARY CONSTRUCTION SIGNAGE

A. The contractor must provide an adequate number of signs to direct the public around the construction site, as determined by the SEPTA PM. These signs must be professionally fabricated and maintained/replaced
to keep an “as new” appearance; assume 20 directional signs, no greater than 720 square inches (24” x 30”).

B. The contractor must install project identification signs as defined in Sections 01570 and 01580. These signs must be professionally fabricated and maintained/replaced to keep an “as new” appearance.

C. All signage shall be made of fireproof material or coated with fire retardant paint.

1.10 PROTECTION OF NEW WORK AND AREAS OUTSIDE OF THE PROJECT

A. The contractor shall take all necessary precautions to protect new work (whether executed by him or others). All damage which does occur shall be repaired to the satisfaction of the SEPTA PM at no cost to SEPTA.

B. The contractor must avoid damaging all property and facilities not included in the project scope. All damage which does occur shall be repaired to the satisfaction of the SEPTA PM at no cost to SEPTA. If non-SEPTA property is damaged it must be repaired to the written satisfaction of the owner and at no cost to SEPTA.

1.11 DUST CONTROL

A. The contractor shall take all necessary precautions to eliminate dust and dirt created during the construction process from entering non-project areas and those areas not owned by SEPTA. The contractor shall be responsible for cleaning affected areas and restoring them to their preconstruction condition to the satisfaction of the property owner and at no cost to SEPTA.

1.12 SECURITY

A. The Contractor shall provide adequate security measures to protect material, equipment, and work from incidental and intentional damage or theft at project site locations, staging areas and fabrication yards.

B. The use of guard dogs and the possession of firearms on SEPTA property are prohibited.

C. The contractor shall be responsible for supplying the following security measures:
1. Exterior lighting of 20-30 lux within the yard areas.

2. 8’ high chain link fence enclosure with gate(s) so the yard areas may be fully secured during non-work periods. Chain link fence fabric to have openings no greater than 2½”.

3. A 24-hour security presence shall be required at the project and yard areas during non-work periods. Security guards shall have telephone access and an emergency contact list at all times.

D. The Contractor shall submit to the Project Manager a plan layout of the security measures within 30 days after Notice to Proceed (NTP). This information may be included in the compound plan required by 1.06 D above.

END OF SECTION
SECTION 01505 - MOBILIZATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies the mobilization of the construction plant and equipment at the Work site; for materials and supplies necessary for the prosecution of the work, but not to be incorporated in the Work; for construction of temporary facilities; for work preparatory to commencing the Work and for demobilization of the construction plant.

1.02 RELATED WORK

A. Agreement
B. Section 01010: Summary of Work.
C. Section 01011: Summary of Project.
D. Section 01500: Construction Facilities and Temporary Controls.

1.03 SUBMITTALS

A. Submit within 30 days after the Notice to Proceed, a layout of the proposed construction site including fences, roads, buildings, trailers and storage areas. If non-SEPTA property is to be utilized, submit a proposal and obtain tentative approval for this arrangement before committing to any lease arrangements or other legal agreements for the use of this land.

PART 2 - PRODUCTS

2.01 PLANT AND EQUIPMENT

A. Construction plant and equipment shall be of the capacity, type, quality, function, and in the quantity necessary for the timely prosecution of the Work.

PART 3 - EXECUTION

3.01 GENERAL
A. Construction plant, equipment, materials, supplies, temporary buildings, facilities, and other items necessary for mobilization shall be available at the work site at the times they are to be built, used, installed, or operated.

B. Construction plant location shall be approved by SEPTA and shall be appropriately close to the portion of the Work for which it will be used. The construction plant, including equipment and personnel, shall have sufficient capacity, in the opinion of the Project Manager, to permit a rate of progress which will insure completion of the Work within the contract time required by the Agreement and shall also have sufficient excess capacity for emergencies and overloading.

C. The Project Manager shall have the right to reject construction plants and apparatus which, are in its opinion, unsafe, improper, or inadequate. Rejected construction plants and apparatus shall be brought to acceptable condition or shall be removed from the jobsite by the Contractor.

3.02 DEMOBILIZATION

A. Upon completion of the Work. The Contractor shall remove construction plant, equipment, materials, supplies, temporary building, facilities, and other items that were necessary for mobilization. The Contractor shall return the area allocated for the construction plant to its condition prior to the start of the Work.
SECTION 01510 - MAINTENANCE, SUPPORT AND RESTORATION OF EXISTING UTILITY FACILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies the coordination, maintenance, support, protection, and restoration requirements of existing public and private utilities affected by construction.

B. Existing Utility Facilities: Existing utility facilities include but are not limited to the following:
   1. Verizon – telephone facilities and services.
   2. PECO Energy – electric light and power facilities and services.
   4. Amtrak – fiber optic communications ductbank and electric traction.
   5. MCI – fiber optic communications cables in Amtrak ductbank.
   6. Quest – fiber optic communications cables in Amtrak ductbank

1.02 RELATED WORK

A. Section 01010: Summary of Work
B. Section 01011: Summary of Project
C. Section 01060: Regulatory Requirements and Safety
D. Section 01064A: Railroad Safety Requirements
E. Section 01300: Submittals
F. Section 02050: Demolition
G. Section 02220: Grading, Excavation, and Backfill
H. Section 02222: Excavation, Backfill, and Compaction for Utilities
1.03 SUBMITTALS

A. Shop Drawings and Working Drawings:

1. The Contractor shall submit working and shop drawings indicating its plan and schedule for performance of work to the appropriate Utility Company for review and approval. A copy of this submittal shall be furnished to SEPTA and or Architect/Engineer in accordance with the requirements of Section 01300 by the Contractor.

2. The Contractor’s Work Drawings shall detail the actual location of existing facilities, including aerial interference which these facilities present to new work, as well as proposed method of proceeding with actual construction and details of proposed support systems.

3. Do not commence work until written approval has been received from the affected Utilities and the Project Manager.

B. Documentation:

1. Notice of commencement of work:
   a. The Contractor shall provide to the Utility notice of 7 days, or as otherwise required by the affected Utilities, prior to date of intended commencement of operations to parties having surface, subsurface or overhead structures in the construction area.
   b. The Contractor shall comply with the provisions of 73 P.S. 176 et seq., which sets forth PA’s "One Call System."
   c. Provide copies of notices to the Project Manager.

1.04 QUALITY ASSURANCE

A. Codes, Regulations, Reference Standards, and Specifications:

1. Codes and regulations of the specific jurisdictional authorities.

2. Published standards of specific owning utility agency.
1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Coordinate with the specified utility companies who are furnishing materials for the work to determine availability, locations, and required methods of storage and care of materials prior to incorporation into the work.

B. Transport, store, and handle materials in accordance with the requirements of the utilities.

1.06 JOB CONDITIONS

A. Location of Facilities:

1. Prior to start of any Work, contact the Pennsylvania-One-Call System in order to provide for locating and marking underground facilities.

2. Locations of existing facilities shown are plotted from available records; however, these locations are not guaranteed.

3. Verify locations of facilities by field investigation within and adjacent to limits of the project which may be affected by construction operations. Avoid damage or disruption of facilities during operation.

4. Upon encountering an existing facility, which is not shown, or upon ascertaining that a facility differs from that shown, determine ownership, use, and disposition of such facility, and proceed as follows:

   a. If the facility is abandoned or is to be abandoned, perform necessary work for either condition as shown or specified.

   b. If facility is to remain in service, perform support and restoration work in accordance with these specifications.

B. Protection of Amtrak Communications and Ductbank:

1. Contractor is responsible for locating and protecting the existing Amtrak communications ductbank on the outbound side of the site. The Contractor shall develop and submit to the SEPTA PM a plan for protecting the ductbank from any construction-related activities within 4’ of the line in any direction. No excavation shall be permitted in this area prior to SEPTA and Amtrak approval of the contractor’s plan.
C. Coordination with Utilities:

1. Contractor shall allow the Utility sufficient time to accomplish its work.

2. Contractor shall provide the Utility with the schedule of utility relocation/protection to permit coordination with the Contractor’s work sequence.

D. Responsibilities of Contractor:

1. Maintain and protect facilities.

2. Give notice of commencement of Work as specified.

3. Notify the Project Manager and the Utility of damage to facilities caused by construction operations. Repair or reimbursement for repair of such damage is the responsibility of the Contractor. Damaged electrical cables will be repaired or replaced as determined by the Utility with all costs borne by the Contractor.

4. Provide access for inspection of facilities and for emergencies involving utility services.

5. Permit free and clear access to utility personnel for purposes of inspection, maintenance, providing additional service and construction of new facilities, if required.

6. When approved working drawing or shop drawings show a temporary facility provided for the Contractor’s benefit, the Contractor shall supply necessary materials and perform this work, at no cost to SEPTA.

7. The Contractor is responsible for direct payment to the Utility for work accomplished by the Utility at the request of the Contractor for the Contractor’s convenience or for preferred method and means of the Contractor.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Backfill: In accordance with Section 02220.
B. Utility Facilities: As specified in other Sections of these specifications and as required by the Utility owner.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall maintain complete in-place continuity of all utility service, and provide proper support and protect utility facilities in accordance with the Specifications of the Utility affected.

B. Support facilities so as not to expose them to undo vibrations. Support and maintenance of these facilities will be subject to inspection by the Utility.

C. Repair or replace public utilities damaged during construction at no cost to SEPTA, to the satisfaction of the Utility.

D. Assume the cost for repair or replacement of private utilities damaged during construction, which will be repaired or replaced by the private Utility.

E. Conform to the specifications and standard practices of the affected utility owners. Coordinate with utility owners, which work, shall be done by Contractor and which work shall be done by the Utility owner.

F. Provide, install, and maintain all temporary facilities required to provide interim utility service when a utility facility is to be relocated and when a utility facility to be replaced is abandoned prior to replacement.

3.02 EXCAVATION AND BACKFILLING OF UTILITY TRENCHES

A. Excavate and backfill utility trenches in accordance with Section 02220 and with the requirements of the affected utility.

B. Proceed with caution in areas of utility facilities; expose them by hand excavation or other methods acceptable to facility owner.

3.03 PAVEMENTS, SIDEWALKS, CURBS AND GUTTERS AND OTHER FEATURES

A. In accordance with Section remove pavements, sidewalks, curbs and gutters, and other existing features where necessitated by utility trenches
and those which interfere with the successful completion of the required work and may be directed to be removed by the Project Manager.

B. Replace pavements, sidewalks, curbs and gutters and other existing features, required to be replaced or directed to be replaced by the Project Manager in accordance with other sections of these specifications.

C. Place temporary pavements where necessitated by sequence of operation.

3.04 UNSAFE AND UNSUITABLE UTILITY STRUCTURES

A. General Requirements:

1. If, upon exposure, condition or location of facility to be supported in place is found to be unsafe for maintenance or support, contact utility for repair or reconstruction procedures.

B. Electric, Communication, and Similar Type Facilities:

1. If structures containing electrical, communication and similar types of cables shown to be maintained complete in place are found upon exposure to be incapable of being maintained in place because of condition, location, or both contact Utility for repair or reconstruction procedures.

2. When service box, manhole, or conduit structure containing electrical or communication cables is broken away, contact Utility for repair or replacement procedures.

3. Exercise care when working in vicinity of telephone structures containing coaxial cable or fiber optic cable which cannot withstand movement.

END OF SECTION
SECTION 01520 - TEMPORARY CONSTRUCTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Temporary facilities include the work associated with installation of the temporary parking lot and associated drainage and lighting on the Outbound side. Also included is the temporary low-level walkway provided at the north end of the inbound side.

B. Temporary shoring may be required during installation of the overpass. The need for temporary shoring will be determined by the General Contractor based on his specific means and methods for installing the overpass structure.

1.02 RELATED WORK

A. Section 01300: Submittals.

B. Section 01500: Construction Facilities and Temporary Control.

C. Section 02160: Excavation Support and Protection.

1.03 SUBMITTALS

A. Submit shop drawings as required by the appropriate technical specifications. Submit contractor work plan for installation of the temporary low-level walkways in accordance with Specifications 01141A and 01142A.

1. Temporary structures submittal must be stamped by a licensed engineer.

1.04 QUALITY ASSURANCE

A. Section 01400: Quality Requirements.

1.05 SITE CONDITIONS

Not Used
PART 2 - PRODUCTS

Refer to the requirements of the appropriate technical specification.

PART 3 - EXECUTION

3.01 CONSTRUCTION PHASING

A. Construct temporary facilities in accordance with the sequence shown on the Phasing Plans included in the Construction Documents.

END OF SECTION
SECTION 01520A

REQUIREMENTS FOR TEMPORARY PROTECTION SHIELDS FOR DEMOLITION AND CONSTRUCTION OF OVERHEAD BRIDGES AND OTHER STRUCTURES

PART 1   GENERAL

1.01  SCOPE

A. This engineering practice describes items to be included in the design and construction of temporary protection shields for construction overhead and near to Amtrak tracks.

B. Use of this specification is as required by Amtrak, as described in Amtrak Engineering Practice EP3014.

1.02  RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.03  DEFINITIONS

A. CHIEF ENGINEER: Amtrak Vice President, Chief Engineer.

B. RAILROAD: National Railroad Passenger Corporation (Amtrak), and/or the duly authorized representative.

C. ENGINEERING PRACTICE: Amtrak Engineering Practices establish a system of uniform practices, notices, and instructions for the Amtrak Engineering Department, providing current, permanent and temporary, departmental procedures and policies.

1.04  SUBMISSION REQUIREMENTS

D. Unless otherwise directed in the Contract, the Contractor shall submit five sets of plans and calculations to the authorized representative of the Chief Engineer, Structures, whose name and address will be provided at the project pre-construction meeting.

E. Submitted calculations and plans shall be signed and sealed by a Professional Engineer, registered in the state in which the work will be performed.

F. The Contractor shall revise and resubmit plans and calculations as many times as necessary, until a complete and correct site-specific work plan for crane/hoisting operations has been approved.
PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.01 CONTRACTORS WORKING ON OVERHEAD OR NEARBY DEMOLITION AND/OR CONSTRUCTION ADJACENT TO AMTRAK TRACKS SHALL CONFORM TO THE FOLLOWING DESIGN AND CONSTRUCTION REQUIREMENTS FOR TEMPORARY PROTECTION SHIELDING:

A. The Contractor shall maintain a specified level of protection to railroad facilities, during demolition and construction activities that occur overhead and nearby Amtrak tracks, as shown on the Contract Plans, as detailed in the Contract Specifications, and as described below.

B. Prior to the start of construction, the Contractor shall submit to Amtrak for review and approval, detailed, site specific plans for temporary protection shields. The plans will be reviewed as to methods of erection, and as to whether or not the proposed installation will provide the required level of protection. No construction shall proceed until the Contractor has received written approval of the Contractor’s complete, site specific plans, from Amtrak.

C. The Contractor shall design the protection shields to conform to all applicable and governing federal, state, and local laws and regulations.

D. Drawings for the proposed temporary protection shields shall be signed and sealed by a Licensed Professional Engineer. Complete design calculations, clearly referenced to the drawings and easy to review, shall be provided with submission of drawings.

E. Protection shields shall be designed for the following, minimum load and size criteria.

1. The horizontal shield design live load on horizontal surfaces shall be the greater of a minimum of 100 pounds per square foot (psf) [5000 Pascals] or the anticipated live load to be produced by the Contractor’s anticipated operations. When determining the appropriate design live load, the designer shall consider factors such as the physical capacity of proposed debris-catching platforms to retain materials, and the type of equipment the platforms might support. Positive means of demolition and construction controls shall be provided to assure that debris that may collect on the shield will not exceed the design live load. The horizontal protection shield, in plan view, shall cover no less than the area directly over the tracks plus ten feet minimum beyond the centerline of the outermost tracks.

2. The vertical shield shall be designed to carry a minimum 30 psf [1500 Pascals] allowance for wind load. The vertical shield shall
extend a minimum of 6’-6” [1950 millimeters] above the top of the adjacent surface, such as curb or sidewalk. Anti-climb wings shall be installed at each end, as necessary, to restrict access to the railroad property.

F. The vertical and horizontal clearance envelopes required for maintenance of railroad operations, shall be indicated on the site specific work plans. These clearances are subject to review and approval by Amtrak. If applicable, both temporary and permanent envelopes shall be indicated on the plans. The temporary protection shields shall be installed outside the limits of these minimum vertical and horizontal clearances shown on the site specific work plans.

G. In electrified territory, temporary protection shields shall be bonded and grounded.

H. Temporary protection shields shall be designed and constructed to prevent dust, debris, concrete, formwork, paint, tools, or anything else from falling onto the railroad property below.

I. The temporary protection shields shall be attached to the structure in accordance with site specific work plans submitted by the Contractor and approved by Amtrak. Drilling in the structural members and welding will generally not be permitted in members that are scheduled to remain in place in the reconstructed structure. For existing members scheduled for demolition or for later reconstruction, any proposed attachment shall be designed with consideration of potential existing, deteriorated conditions.

J. The Contractor shall provide the Amtrak on-site representative, for review and approval prior to any construction activity in the affected area, a proposed construction schedule for the installation, maintenance, and removal of the temporary protection shields.

K. The temporary protection shields shall be installed prior to the start of any other work over the railroad in the affected areas. No construction shall proceed until the Amtrak on-site representative reviews and approves the Contractor’s installed protection. Before proceeding with the work, Amtrak must be satisfied - in its sole judgment - that sufficient protection has been provided to proceed with the work.

L. The Contractor shall install and remove temporary protection shields only when an Amtrak representative is onsite.

M. The Contractor shall no install or remove temporary protection shields during train operations.

N. Temporary protection shields shall remain in place for the duration of construction activities over and nearby the railroad in the affected areas.
The Contractor may remove temporary construction only after approved by Amtrak on-site representatives.

O. Where site-specific conditions impose insurmountable restrictions to the design of temporary construction conforming to the limitations listed above, the design of temporary construction shall be developed in close coordination with Amtrak design review personnel. The Chief Engineer, Structures shall provide final approval of temporary construction that does not conform to the above limitations.

END OF SECTION
SECTION 01570 - MAINTENANCE AND PROTECTION OF VEHICLES, PEDESTRIANS AND PASSENGERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work specified in this Section consists of furnishing, installing, maintaining, and subsequently removing temporary traffic control devices, and temporary traffic striping and markings; furnishing flagmen and police protection, as required by the local Jurisdiction (Tullytown Borough). If the work does require flagging and affects a state highway, the flagman must receive state training and approval.

The Work also includes controlling, warning, guiding, and protecting vehicles and pedestrian traffic on streets and sidewalks affected by construction of the Project, and adjacent to worksite; maintenance and control of SEPTA passengers on, or adjacent to, the worksite, ensuring unimpeded access to buildings and/or SEPTA Facilities adjacent to the worksite; and the closing of streets and sidewalks; all as specified and directed by the Contract Documents including Maintenance of Traffic and Construction Phasing Contract Drawings.

B. The Contract Drawings detail the approved vehicle traffic and pedestrian control plan required for the Work. The Contractor shall prepare working drawings showing proposed traffic control devices and shall apply to Tullytown Borough for any permits necessary to work in the public right-of-way.

Any proposed changes to the indicated vehicle traffic control plan shall be shown on working drawings prepared by the Contractor and shall be submitted to the Tullytown Borough for approval. A copy of the revised and approved drawings shall be transmitted to the SEPTA Project Manager.

C. The Contract Drawings detail the SEPTA approved passenger control plan required for the Work. The Contractor(s) passenger control plan can be submitted with the work plan (Section 01010) and Site Specific Work Plan, if applicable.

Any proposed changes to passenger control plan shall be shown on working drawings prepared by the Contractor and shall be submitted to the Project Manager for SEPTA’s review.
1.02 RELATED WORK

A. Section 01010: Summary of Work
B. Section 01011: Summary of Project
C. Section 01041: Project Coordination
D. Section 01060: Regulatory Requirements and Safety
E. Section 01300: Submittals
F. Section 01500: Construction Facilities and Temporary Controls
G. Section 01520: Temporary Construction
H. Section 01530: Barriers and Enclosures
I. Section 01580: Project Identification Signs and Other Construction Signage.

1.03 SUBMITTALS

A. The Contractor shall submit a Traffic Control Plan (TCP) to PENNDOT and Tullytown Borough for approval (copy to Project Manager) before starting Work; submit an updated TCP every time it becomes necessary to modify traffic operation or undertake construction in accordance with the requirements of PENNDOT Publication No. 203, "Work Zone Traffic Control." The TCP shall show and describe proposed locations and time durations of the following:

1. Pedestrian and public vehicular traffic routing.
2. Traffic blockage and lane reductions anticipated to be caused by construction operations.
3. Allowable on-street parking within immediate vicinity of worksite.
4. Access to buildings immediately adjacent to worksite.
5. Driveways which will, and those which will not, be blocked by construction operations.
6. Temporary traffic control devices required on streets and sidewalks affected by construction.
7. Temporary commercial and industrial loading and unloading zones.

8. Police Traffic Protection – if police enforcement are required as part of the final approved plan, define the extent, circumstances, and type of active police protection in the plan.

B. The Contractor shall submit other incidental submittals required by Tullytown Borough and PENNDOT to assure safe maintenance and protection of vehicles, pedestrians, and passengers.

C. The Contractor shall submit a Passenger or Pedestrian Control Plan in accordance with the construction Phasing Drawings. All Passenger control signage shall be submitted to SEPTA for review prior to Fabrication.

1.04 QUALITY ASSURANCE

A. Referenced Standards:


B. A color proof of all graphics must be reviewed by SEPTA prior to fabrication and use.

1.05 JOB CONDITIONS

A. At various times during the construction period, as defined in 1.03A8 above and/or as required by the day to day work; the Contractor shall be required to provide uniformed police officers to maintain traffic control within the construction area. The Contractor shall include the costs for all police traffic protection activities associated with the work in the price as bid for the Work. No extra costs will be considered for police protection during the Work of this Contract. The Contractor shall enter into an Agreement with the Tullytown Borough to be directly reimbursed for furnishing the required police protection.
PART 2 - PRODUCTS

2.01 TEMPORARY TRAFFIC CONTROL DEVICES

A. The Contractor shall conform to the latest Regulations for Official Traffic Control Devices, 67 PA Code, Chapter 211; 67 PA Code, Chapter 203; and, if required, as follows:

1. PENNDOT Publication 408, Section 627.2, Temporary Concrete Barrier.

2. PENNDOT Publication 408, Section 962.2, Painting Traffic Lines and Markings.

B. Signs: As recommended in the referenced PENNDOT publications.

C. Warning lights and flares; Capable of alerting approaching traffic to hazards, unsafe conditions, and variances to normal traffic patterns.

D. High-rise warning flag unit: Have three flags mounted nine feet above the base.

2.02 FLAGMEN SIGN

A. Twenty-four (24) inches, octagonal and attached to a five-foot handle. One side of sign shall be a stop sign, and the other side of the sign shall be a slow sign.

B. Stop Sign shall have white reflectorized letters, not shorter than eight inches, spelling STOP on a reflectorized, red, octagonal background.

C. Slow Sign shall have black letters, not shorter than eight inches, spelling SLOW on a reflectorized, orange, diamond background. The area between diamond and edge of flagmen sign shall be black.

2.03 STATION CONTROL DEVICES

A. All signs shall be of commercial quality and shall conform to SEPTA’s graphic design standards. Submit all signs for review by SEPTA at least ten (10) working days in advance of any work that will disrupt pedestrian movement, disrupt transit operations, or necessitate closing of stairways, entrances, etc. Do not perform the work until the signs are in place.

B. Refer to specification Section 01580.
PART 3 - EXECUTION

3.01 TRAFFIC CONTROL DEVICES AND DETOURS

A. Provide in accordance with the latest Regulations for Official Traffic Control Devices, 67 PA Code, Chapter 211; 67 PA Code, Chapter 203.

3.02 CONTROLLING VEHICULAR, PEDESTRIAN ACCESS AND FLOW ADJACENT TO WORKSITE /AND/OR STATION

A. Fabricate and install passenger control signage and other devices according to the approved passenger control plan.

B. Maintain each sign throughout the project in a “like new” condition, free of all unrelated signs, posters, painting, advertising and defacement of any kind. Replace signs as necessary to maintain them in the “like new” conditions.

C. Remove all signs from the site and repair damages when the temporary condition no longer is necessary or within 2 days of notice from SEPTA.

3.03 CONTROLLING PASSENGER FLOW ON OR ADJACENT TO WORKSITE AND/OR STATION

A. Fabricate and install passenger control signage and other devices according to the approved passenger control plan.

B. Maintain each sign throughout the project in a “like new” condition, free of all unrelated signs, posters, painting, advertising, and defacement of any kind. Replace signs as necessary to maintain them in the “like new” conditions.

C. Remove all signs from the site and repair damages when the temporary condition no longer is necessary or within two (2) days of notice from SEPTA.

3.04 REMOVAL OF DEVICES

A. Remove all temporary signs when they are no longer required for the work and before final closeout of the project.

END OF SECTION
SECTION 01580 - PROJECT IDENTIFICATION SIGNS AND OTHER CONSTRUCTION SIGNAGE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of furnishing and installing project identification signs and temporary construction signs as described below and required by the Contract Documentation.

1.02 RELATED SECTIONS

A. Section 01300: Submittals.

B. Section 01500: Construction Facilities and Temporary Controls.

C. Section 01570: Maintenance and Protection of Vehicles, Pedestrians, and Passengers.

D. Attachment: SEPTA Starburst Sign.

1.03 SUBMITTALS

A. In accordance with Section 01300, submit the following:

1. Shop drawings of each sign scheduled to be utilized during construction. Indicate materials, size, location, fonts, and colors proposed for use.

2. After consultation with the Project Manager, submit the following sign information for review and approval by SEPTA.

   a. Sketch and narrative description identifying the location, orientation and mounting height of each sign.

   b. Total quantity of each sign to be utilized

   c. Name, address, telephone number, and key contact person of the company responsible for the fabrication of the sign.

3. Hardware and mounting details for erection of each sign.
1.04 JOB CONDITIONS

A. Signs shall be commercial quality and proofs shall be approved by SEPTA prior to fabrication.

1. Install Project Identification Signs within forty-five (45) calendar days after the Notice to Proceed.

2. Temporary Signage shall be submitted thirty (30) days prior to start of each construction phase for review and approval of SEPTA Project Manager.

3. The No Trespassing Sign is to be installed within the Contractor's Project compound and other areas to be determined by the Project Manager.

B. Non-project Signs:

Non project signs, such as business advertisements or labor union notices may be permitted subject to review by the SEPTA Project Manager whose decision will be final.

PART 2 - PRODUCTS

2.01 PROJECT IDENTIFICATION SIGN MATERIAL

A. Sign Material

Cut sign base from a single 4’ x 8’ x ¾” thick, waterproof exterior. A-B grade plywood with a smooth, finished surface. Round edges to a 1/8” radius. Joints will not be permitted.

B. Mounting Material:

1. General: Provide mounting frames and hardware of such quality to be able to support the sign under all weather conditions for the duration of the project.

   a. Unless surface mounted, support signs with frames constructed with painted pressure treated dimension lumber or other approved non-conductive material of sufficient size to brace against weather conditions.
b. Secure surface mounted signs using anchoring devices approved by SEPTA.

2. Hardware:
   a. Galvanized screws or bolts with galvanized nuts and washers.
   b. Paint all hardware, visible in the finished assembly, to match the adjoining surface of the sign or mounting.

3. Posts:

   Pressure treated dimensional lumber or other non-conductive material acceptable to SEPTA.

C. Paint:

   1. Paint sign surfaces, posts and mounting frames with one coat of primer sealer and two coats of white semi-gloss enamel on all sides and edges.
   2. Use paint manufactured for exterior use by a manufacturer acceptable to SEPTA.

D. Acceptable Fabricator: A company specializing in and having documented experience in the fabrication of graphic signs. Submit the fabricator’s credentials to the SEPTA Project Manager for approval before any fabrication.

E. SEPTA Project Sign:

   1. Provide three (3) SEPTA Project Signs. Sample SEPTA Project Sign is shown on Sketch # SEPTA-1, attached at the end of this Section.
   2. Size: 4’ x 6’
   3. SEPTA will provide the Contractor with a proof copy of the information to be displayed on the SEPTA Project Sign at the Pre-Construction Meeting.
   4. Obtain the services of a graphic sign company to transfer the information contained on the SEPTA provided computer disk onto 0.1 mm pressure sensitive vinyl with Weather-All Fluorinated
Polyurethane Coating, or approved equal film. The vinyl shall be mounted onto the sign surface.

5. Do not include information on the SEPTA Project Signs except that contained on the computer disk provided by SEPTA.

6. The Contractor is responsible for advising the Project Manager of any problems that occur during the production of the SEPTA Project Sign.

2.02 TEMPORARY SIGNS

A. Temporary signs are considered to be any sign not included in Article 2.01 above that is required to be erected during the construction phase of the project and removed at the completion of the construction phase of the project. These signs include, but are not limited to, Pedestrian Wayfinding signs, Field Office Signs, and Safety and instructional signs for workers and visitors. This section does not include signs utilized and required for the purpose of identifying public street traffic closures and/or detours.

3. As required by law and for pedestrian wayfinding during construction. Submit proposed signage to SEPTA Project Manager for approval before fabrication.

B. Pedestrian wayfinding signs

1. Each sign not to exceed 750 sq. in unless specifically required by the SEPTA Project Manager.

2. Signs shall be black Helvetica bold letters on white background with key information in red.

3. If vandalized, signs must be replaced at no cost to SEPTA.

4. All signs must meet accessibility guidelines.

5. Total sign count not to exceed 30 signs per phase.

6. If in satisfactory condition, signs may be reused phase to phase with approval of the SEPTA PM.

C. Field Office Signs:

1. Size: 4' x 5' wide.
2. Letter with black enamel paint, using block letters at least 4" high, with the Contract name. Contract number and the words “CONTRACTOR’S FIELD OFFICE” or “SEPTA’S FIELD OFFICE” as appropriate with each word painted on a separate line.

3. Where the field offices to be identified are not readily visible from the work site entrance, paint a directional arrow on the sign and locate the sign near the entrance. In this case, provide additional signs of reduced size with the words “CONTRACTOR’S FIELD OFFICE” or “SEPTA’S FIELD OFFICE” as necessary to direct traffic to, and identify the field office location(s).

D. No Trespassing Sign

1. Sign base will be white baked enamel aluminum, 12” wide, 18” high and .062” thick. Additional prints of two colors will be used; fire red and black. 1” border on the top and both sides and ½ “ border on the bottom.

2. Sign Information
   a. 1” down from the top is a 10” wide x 2.75” high fire red block with reversed out white copy at 1.5” Helvetica. Med. Acct. A. K. Rev. M that reads: WARNING centered in caps.
   b. 5” down from the top is the baseline for 0.75” Helvetica. Med. Acct. A. K. Rev. M, black copy to read: NO TRESPASSING centered in caps.
   c. 8.75” down from top is the center of a 6” fire red outlined circle .5” thick with a diagonal 45-degree slash from the upper left to the lower right of the circle. Behind the circle and slash is a 4.5” pictograph of a walking pedestrian.
   d. 13” down from the top is the baseline for 0.75” Helvetica. Med. Acct. A. K. Rev. M, in black copy to read: AUTHORIZED centered in caps.
   e. 14.125” down from the top is the baseline for 0.75 Helvetica. Med. Acct. A. K. Rev. M, in black copy to read: PERSONNEL ONLY centered in caps.
   f. 16.5” down from the top is the baseline for 0.375” Helvetica. Med. Acct. A. K. Rev. M, broken down in 4 lines of black copy to read:
All Others Will Be Prosecuted In Accordance With the Penalties Provided In Section 3503 OF The Pennsylvania Crimes Code.

Centered with initial caps.

g. 17.5" down from the top, flush right, is the base line for 0.5" SEPTA logo in black.

3. Fasteners are not incorporated in the sign. Contractors can drill holes in the signs to mount them on fencing, walls, and barricades not to obstruct the message of the sign.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to erection, examine all signs to verify that the size, material, and wording are in accordance with the approved shop drawings.

B. Examine areas and conditions under which the signs are to be located. Prior to erection, notify the Project Manager of any conditions that may differ from the information identified on the sign submission.

3.02 INSTALLATION

A. Install signs in accordance with approved shop drawings and as directed by the Project Manager. Support all non-surface mounted signs on a minimum of two posts, anchored into the ground at a depth sufficient to provide rigid support of the sign during all weather conditions.

B. Provide Project Signs and SEPTA’s Field Office Signs at places designated by SEPTA.

C. No Trespassing signs shall be posted on every side at 40’ spacing on all temporary fences and walls, barricades and compound fencing.

D. Temporary Signs:

1. Field Office Signs: Provide one sign for the Contractor’s field office to indicate the Contractor’s location.

2. Provide and install other temporary signs deemed necessary for the project by SEPTA.
E. Sign Maintenance: Maintain all signs throughout the course of construction from installation until contract completion, keeping them clean, free from graffiti, in good repair, and free of obstruction. Provide and maintain adequate protection against weather so as to preserve all work, materials, equipment, apparatus, and fixtures free from injury or damage. Maintain all signs free of all unrelated signs, posters, painting, advertising, and defacement of any kind. Within five days of notice, the Contractor shall clean, repair or replace signs as necessary to maintain them in a “like-new” condition.

F. Within five days of final acceptance of the project by SEPTA, remove and dispose of all project identification and temporary signs. If any signs have disfigured a surface which is to become part of the final work, repair or replace the surface to the SEPTA Project Manager’s satisfaction. All costs for the removal and disposal of signs shall be borne by the Contractor.

END OF SECTION
SECTION 01590 - SEPTA FIELD OFFICE

PART 1 - GENERAL

1.01 DESCRIPTION

A. At a location approved by the SEPTA Project Manager and within 30 days after receipt of Notice to Proceed, the Contractor shall provide and maintain until completion of the Work a temporary field office for the occupancy and use of SEPTA and its employees, with a minimum of 600 square feet of usable area divided into two areas, and equipped as specified in this section. At the completion of the work, the Contractor shall provide for the removal of the temporary field office.

1.02 RELATED WORK

A. Section 01010: Summary of Work.
B. Section 01011: Summary of Project.
C. Section 01041: Project Coordination.
D. Section 01300: Submittals.
E. Section 01500: Construction Facilities and Temporary Control.

1.03 SUBMITTALS

A. In accordance with Section 01300, submit within ten (10) days after receipt of the Notice to Proceed, a plan detailing SEPTA’s Office and associated spaces including parking and a bill of materials of all required office equipment and supplies for the review of the Project Manager.

PART 2 - PRODUCTS

A. Furnish the field office with the following good quality equipment and furniture:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Desk (60” x 30”) with one file drawer and three drawers, all lockable, and swivel chair for the desk</td>
</tr>
</tbody>
</table>
1 4-foot by 8-foot plan table and padded stool

1 Networkable Color Multi-function scan, copier, fax machine (letter/legal and ledger sizes), sorter/collater, automatic stapler. Sharp model # 2615N 3115N or equal

2 Tablet computers, 4th generation Intel Core i5-4300U 1.90 GHz, 256GB ram, wireless Ethernet 802.11ac/802.11a/b/g/n, with the following ports (Full-size USB 3.0, microSD card reader, Headphone jack, Mini DisplayPort, Cover port, Charging port), 2 flexible keyboard/covers, 2 docking stations, 2 carrying cases, 2 stylus/pens. Pre install Windows 7 operating system, and most current version of MS Office Professional.

1 Desktop Personal Computer: Intel Pentium Dual-core processor, 2.5 GHz processor with 2 GB RAM, 60 GB hard drive, 17" flat panel monitor, CD/DVD +/- RW drive, sound card, speakers, 104+ keyboard, mouse and pad, 56K modem with fax and voice capability, Windows 7 operating system, most current version of MS Office Professional, and HP LaserJet printer/scanner capable of scanning and printing 8½” x 11” and 11” x 17” prints.

1 Wireless a/b/g/n router (with wireless protected setup)

2 Wireless Ethernet range extenders (with wireless protected setup).

10 Temperature data recorders and 1 USB docking station (Logtag TRIX-8 or equal).

1 Rolling Plan Storage Rack with six (6) stick

2 File Cabinets with four (4) legal sized drawers, fire resistant, with lock and two (2) keys

2 Swivel type armchairs

10 Folding chairs

2 Bookcases (36” x 42”) with four (4) shelves

1 folding conference table (30” x 72”)

1 Coat Rack and 10 plastic hangers

1 Chalk board (60” x 36”), wall mounted with chalk and eraser

1 Automatic Drip Coffee Maker (10-cup capacity)

2 Wastepaper Baskets
1 Storage Cabinet (36” x 18” x 72”) with lock
1 Fire Extinguisher
1 Complete First Aid Kit
1 HVAC System (includes Air Conditioner) capable of maintaining a temperature of 70 degrees indoor
1 Sanitary Facilities
3 Telephones, one with answering service provided through the telephone company
1 Thermometer (indoor and outdoor)
1 Surface Temp Thermometer
1 Combination Water Cooler/refrigerator (one cubic foot minimum) with hot and cold water spigots
1 Paper cup dispenser and continuous supply of paper cups.
1 Wall Clock
1 Microwave oven, minimum 0.07 cubic meters

2. All furnishings and equipment are the property of the Contractor.

B. Office Supplies

1. Quantity  Description
   3 2-inch, 3-ring, loose-leaf binders.
   2 6-foot, wood folding rule.
   2 25-foot metal tapes.
   2 Sets, heavy-duty rain gear and slip-on mud boots.
   1 Digital camera, min 6 mega pixels, 5x optical zoom with flash, 1 GB compact flash memory card. Panasonic or approved equal.
   1 Current year Means Construction Cost Data Manuals (Mechanical, Electrical, Building Construction).

3. All office supplies shall become the property of SEPTA upon completion of the Work.

PART 3 - EXECUTION

3.01 OFFICE

A. Weather tight, with barred windows and doors, each equipped with screens and adequate locking devices. Exterior doors shall be equipped with cylinder locks and dead bolts, both keyed alike with two
keys and also provided with burglar-proof bars and locks across the doors.

B. Insulated exterior wall, ceilings, and floors.

C. Floor covered with resilient flooring material such as asphalt tile or linoleum.

D. Restroom with lavatory, toilet, soap holder, toilet paper, holders, paper towel dispenser, wastepaper basket, mirror, and hot and cold water supply, or restroom facilities commensurate with Contractor's own on-site facilities.

E. Sufficient lighting to provide a minimum of 100 foot-candles at desk light uniformly in all areas.

F. Grounded duplex electrical receptacles around interior walls at approximately 10-foot spacing.

G. Automatically controlled heating and air-conditioning systems with thermostats, capable of maintaining the office at an ambient temperature ranging between 64 and 78 degrees F. The Contractor shall provide fuel and bear all costs in connection therewith.

F. The Contractor shall provide water, sewer, and electrical utility service as required.

I. The Contractor shall provide continuous telephone service within the field office and bear all costs in connection therewith, including long distance telephone charges until final completion and acceptance of the work. The Contractor shall provide as follows:

1. Project Manager: two separate phone lines on one unit.

2. One separate unit with two separate phone lines into the field engineer's area.

3. One telephone answering machine connected to Project Manager's line.

K. The Contractor shall provide a continuous Broadband Internet Connection from the Notice to Proceed date to the date that the SEPTA trailers are removed from the job site. The connection speed shall allow data download speeds of 50Mbps and uploads of 20Mbps.
3.02 MAINTENANCE AND SERVICE:

A. The Contractor shall provide all electrical and telephone tie-ins for the field office and provide continuous maintenance of utility tie-ins during the construction period.

B. The Contractor shall provide continuous maintenance during the construction period including daily janitorial service for offices and toilet facilities and provide toiletry supplies as necessary. The Contractor shall clean the windows bi-weekly.

C. The Contractor shall repair or refinish damaged areas as required.

D. The Contractor shall provide supplies for the copying machine for an average usage of approximately 1,000 copies per month.

E. The Contractor shall repair or replace any equipment within 48 hours of becoming inoperable or defective.

F. The Contractor shall pay cost of all utilities including long distance telephone usage.

3.03 SEPTA PARKING

A. The Contractor shall provide a minimum of four (4) parking spaces at the trailer location for SEPTA's use.

3.04 SECURITY

A. The Contractor shall guard against unauthorized or illegal entry and protect the field office against vandalism, theft and mischief. The Contractor shall be responsible for the replacement and/or compensation for any item owned by the SEPTA or its employees, which are related to the subject work, removed or damaged as the result of vandalism, theft, mischief, or illegal entry to the field office.

3.05 REMOVAL

A. Upon project completion, the Contractor shall remove temporary field office and appurtenances from the worksite.

END OF SECTION
SECTION 01600 - MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION

Work of this section includes:

A. Manufacturer’s Recommendations
B. Fulfiling SEPTA sustainability goals and the reuse of materials
C. Transportation and handling
D. Storage and protection
E. Repairs and replacements
F. Product options and substitutions
G. Product content

1.02 RELATED WORK

A. SEPTA Agreement
B. Section 01010: Summary of Work
C. Section 01011: Summary of Project
D. Section 01060: Regulatory Requirements and Safety
E. Section 01300: Submittals
F. Section 01400: Quality Requirements

1.03 SUBMITTALS

A. Submit shop drawings, product data, and other information as required by the applicable specifications.
1.04 QUALITY ASSURANCE:

A. The Contractor shall include in its Quality Assurance Program all procedures that are required to assure the proper handling, storage and installation of all materials and equipment.

B. The contractor must identify the country of origin for all materials subject to source restrictions such as the “Buy America” requirements. Specifically stated relief, including acknowledgement of the country of origin, from these regulations must be obtained in writing before installation of any non-conforming material. Merely obtaining clearance for non-conforming material through the submittal process, even if the country or origin is stated, shall not be interpreted as providing this relief.

C. The contractor shall turn over copies of all bills of lading, packing slips, labels, quality assurance test results and other information which establishes that materials delivered to the job site are consistent with the requirements of the construction documents to the SEPTA PM.

D. The contractor shall maintain on site a copy of storage and installation instructions and Material Safety Data Sheets for all materials being used in the project.

1.05 MANUFACTURERS’ RECOMMENDATIONS

A. The Contractor shall comply with manufacturers' recommendations on product handling, storage, and protection except as noted in the Contract Documents or otherwise approved by SEPTA.

B. If the contract documents deviate from any manufacturer’s recommendations for material utilization and/or installation, the contractor shall bring this to the attention of the SEPTA Project Manager and obtain clarification before proceeding.

1.06 FULFILLING SEPTA SUSTAINABILITY GOALS AND THE REUSE OF MATERIALS

A. For materials identified elsewhere as required to meet specific sustainability goals, the contractor will keep all documentation necessary to establish that specific materials were used in a manner which meets these requirements.

B. The Contractor shall not reuse materials and equipment found on the existing premises, except as specifically called for by the Contract
Documents or as approved through the change order process. If materials are called to be reused, their use shall be documented to the satisfaction of the SEPTA Project Manager and in sufficient detail to fulfill all sustainability documentation requirements.

1.07 TRANSPORTATION AND HANDLING

A. The Contractor shall transport and handle products in accordance with manufacturer’s instructions. Excessive damage during transport and unloading, as judged by the SEPTA PM, may be grounds for rejection of that material.

B. The Contractor shall promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

C. The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

D. The Contractor shall deliver and have delivered products to the job site in their manufacturer's original container with labels intact and legible.

1. The Contractor shall maintain packaged materials with seals unbroken and labels intact until time of installation.

2. The Contractor shall promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to SEPTA.

E. SEPTA may reject, as non-complying, material and products that do not bear satisfactory identification as to manufacturer, country of origin, grade, quality, and other pertinent information.

1.08 STORAGE AND PROTECTION

A. The Contractor shall store and protect products in accordance with manufacturers' instructions, with seals and labels intact and legible.

B. The Contractor shall store sensitive products in weather tight, climate controlled enclosures.

C. For exterior storage of fabricated products which are intended for exterior installation; the Contractor shall provide above ground sloped
supports as a minimum storage strategy. Components shall be appropriately protected from the weather. This storage is subject to the approval of the SEPTA PM.

D. The availability of laydown areas may be limited. Unless otherwise directed by the contract documents, the Contractor shall make off-site arrangements for storage, staging, and deliver material to the site as required to not affect work progress of other contractors and/or create unsafe conditions.

E. The Contractor shall protect all finished surfaces and equipment.

F. The Contractor shall provide protection for finished floor surfaces prior to allowing equipment or materials to be moved over such surfaces.

G. The Contractor shall maintain finished surfaces and equipment clean, unmarred, and suitably protected until final acceptance by SEPTA.

1.09 REPAIRS AND REPLACEMENTS

A. In event of damage, the Contractor shall promptly make replacements and repairs at no additional cost to SEPTA. Do not install damaged material.

B. Additional time required to secure replacements and to make repairs will not be considered by SEPTA as justification for extension to contract time.

1.10 PRODUCT OPTIONS & SUBSTITUTIONS

A. If a product becomes unavailable during the construction process, the contractor must submit an alternative following the normal submittal review process in Section 01300. Under no circumstances may a contractor install an alternate material from that which was submitted, no matter how closely the substitute resembles the original, without the written permission of the SEPTA PM.

1.11 PRODUCT CONTENT

A. All newly installed materials shall be asbestos free.
SECTION 01700 - CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies the requirements for closing out the Contract and supplements requirements specified in Paragraph XII of the Agreement.

B. Contract closeout is the term used to describe the collective requirements that are to be fulfilled at the end of the Contract term in preparation for final acceptance and occupancy of the Work by SEPTA, as well as final payment to the Contractor and the completion of the Contract.

C. Prior to the completion of the whole project, and at the discretion of the SEPTA PM, a Certificate of Substantial Completion may be issued for portions of the Work completed to the full satisfaction of SEPTA in accordance with 1.03 below.

1.02 RELATED DOCUMENTS

A. Agreement

B. Section 01710: Final Cleaning

C. Section 01720: Project As-Built Documents

D. Section 01830: Operation and Maintenance Data

1.03 PREREQUISITES TO SUBSTANTIAL COMPLETION

A. General: The Contractor shall complete the following before requesting the Project Manager's inspection for certification of substantial completion for the Work of the Contract. The Contractor shall list known exceptions in the request.

1. In the progress payment request that coincides with, or is the first request following the date substantial completion is claimed, activities should be either 100 percent complete for the portion of the Work claimed as "substantially complete," or provide a list of incomplete items, the value of incomplete Work, and reasons for the Work being
incomplete. Include supporting documentation for completion as indicated in the Contract Documents.

2. Submit written certification to the Project Manager that the project, or designated portion thereof, is substantially complete.

3. Submit the list of items to be completed or corrected and material delivery dates of major items, as applicable.

4. Advise SEPTA of pending insurance change-over requirements.

5. All contract record documents, maintenance manuals, warranties, and bonds shall be submitted as defined in the Agreement and Sections 01720 and 01830 (if applicable).

6. Obtain and submit releases enabling SEPTA full, unrestricted use of the Work and access to services and utilities. Where required, include occupancy permits, operating certificates, and similar releases.

7. Deliver any access tools and material stock as required and further defined in Section 01830.

8. Change out locks, transmit keys, and transfer security provisions if required by the Specifications.

9. Start up testing and demonstration of equipment and systems shall be completed as specified in Section 01830.

10. Discontinue or change over and remove temporary facilities and services from the project site as directed by the Project Manager along with construction tools and facilities, mock-ups, and similar elements.

11. Touch up and otherwise repair and restore marred exposed finishes.

12. All building operations, maintenance and owner education instructions for the SEPTA's personnel shall be completed as defined in Section 01830 and in the International Green Construction Code.

B. Inspection Procedures: Upon receipt of the Contractor’s request and submittal for inspection, the Project Manager will either proceed with inspection or advise the Contractor of unresolved prerequisites.

1. Following the initial inspection or before (see below), the Project Manager will either prepare the Certificate of Substantial Completion or advise the Contractor of Work which must be performed before the certificate will be issued. The Project Manager will repeat the
inspection when requested and when assured that the Work has been completed.

SEPTA reserves the right to halt inspections at any time if in the opinion of the SEPTA PM, the incomplete items of work are either too numerous or too complex to qualify the project as substantially complete.

2. Results of the completed inspection will form the initial "punch list" for final acceptance but this list may be modified at the discretion of the SEPTA PM.

3. The "punch list" shall include a reasonable time period to effectuate the work, which is mutually agreed upon by all parties.

1.04 PREREQUISITES TO FINAL ACCEPTANCE

A. General: The Contractor shall complete the following before requesting the Project Manager's final inspection for certification of final acceptance and final payment as required by the Agreement, specifically sections regarding the Contractor and Payment and Completion. The Contractor shall list known exceptions, if any, in the request.

1. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit an updated final statement to account for final additional changes to the Contract sum.

3. Submit a Certified copy of the Project Manager's final "punch list" which documents all work which has been completed.

4. Submit final meter readings for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion or as of the date SEPTA took possession of and responsibility for corresponding elements of the Work, if required.

5. Submit Consent of Surety. Affidavit of Payments of Debts and Claims, Affidavit of Release of Liens. General Release by Trade Contractor of Owner, Guarantee against Defects, any Warranties and Maintenance Bonds. Any special documentation such as copy of Engineer or DER Permits or Certification of Occupancy.
6. Submit evidence of final, continuing insurance coverage, which complies with insurance requirements.

7. Submit any remaining record documents and drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information and as defined in the International Green Construction Code.

8. The Contractor shall also issue final project records in an electronic format. Electronic files shall be in a format approved by the SEPTA PM for each specific item. Electronic files shall be organized and named per applicable section or naming protocol as provided by the SEPTA PM.

9. The SEPTA PM may elect progressive submissions of specific listed items during the course of the work. Electronic files shall be created for the following items:

   Submittals
   Construction Permits
   Certificate of Use and Occupancy
   As-Built Drawings
   Manufacturer’s OEM manuals.
   Manufacturers’ Warrantees
   Construction Photographs
   Approved Shop Drawings
   Testing Service Results
   Concrete Delivery Forms
   Steel Certifications
   UL Inspections
   Survey Log Records
   Drilling log Records
   All Engineering design and calculations
   Documentation required by regulatory requirements.
   Soil Management documentation including but not limited to Testing results, Soil disposal documentation, chain of custody and permissions, and Disposal records
   Accident Reports.
B. Reinspection Procedure: The Project Manager will re-inspect the Work upon receipt of the Contractor’s notice that the Work, including “punch list” items resulting from earlier inspections, has been completed except for those items whose completion has been delayed because of circumstances that are acceptable to the Project Manager.

1. Upon completion of reinspection, the Project Manager will either prepare a Certificate of Final Acceptance or will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but which are required for final acceptance.

   a. SEPTA reserves the right to halt inspections at any time if it becomes apparent that the incomplete items of work are either too numerous or too complex to qualify the project as substantially complete.

2. If necessary, the reinspection procedure will be repeated.

END OF SECTION
SECTION 01710 - FINAL CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. The section details work for preparing the site and/or facility for substantial completion.

1.02 RELATED WORK

A. Section 01500: Construction Facilities and Temporary Controls

1.03 SUBMITTALS

A. In accordance with Section 01300, provide information on the proposed cleaning materials and chemicals for the review of the SEPTA Project Manager including but not limited to MSDS Sheets.

1.04 QUALITY ASSURANCE

A. In addition to the standards described in this Section, the Contractor shall comply with pertinent requirements of governmental agencies having jurisdiction.

B. "Clean," for the purpose of the Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

C. For any finishes, SEPTA may require a sample test area be cleaned to insure compatibility and to set a standard for final appearance.

PART 2 - PRODUCTS

2.01 CLEANING MATERIAL AND EQUIPMENT

A. The Contractor shall provide required personnel, equipment, and materials needed to achieve the specified standard of cleanliness.
2.02 COMPATIBILITY

A. The Contractor shall use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material and acceptable to SEPTA.

B. The Contractor shall replace surfaces damaged from improper use of material and/or cleaning methods at no cost to SEPTA.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. The Contractor shall, prior to turning over the substantially completed area to SEPTA maintenance, remove from the area all tools, surplus materials, equipment, scrap, debris, and waste. If any of the Contractor's work continues in the substantially completed area, the Contractor shall continue the cleaning specified in Section 01500. Schedule a final cleaning date as approved by SEPTA with sufficient time for a post-cleaning inspection walk through with the SEPTA PM and a contractor's representative.

B. Site:

1. Unless otherwise specifically directed by SEPTA, the Contractor shall sweep grade areas within the contract limit and paved areas adjacent to the site.

2. The Contractor shall completely remove resultant debris.

3. The Contractor shall remove graffiti from all surfaces and restore surface to original condition.

C. Structures

1. The Contractor shall visually inspect all existing and finished surfaces and remove all traces of soil, waste materials, smudges, graffiti, and other foreign matter.

2. The Contractor shall remove all traces of splashed materials from structure within contract limit and from adjacent surfaces.

3. If necessary to achieve a uniform degree of cleanliness, the Contractor shall wash the exterior of the structure with high pressure detergent.
4. In the event of stubborn stains not removable with detergent, the Contractor shall utilize other cleaning methods (including light particle blasting if needed) subject to SEPTA's written approval and at no additional cost to SEPTA.

5. The Contractor shall remove paint droppings, spots, stains, and dirt from existing and finished surfaces.

6. The Contractor shall clean existing and new glass surfaces and frames, both inside and outside before and after applying anti-vandal film to surfaces as called for in the contract.

D. Finished Surface:

1. The Contractor shall remove all labels and tags strictly used for the convenience of manufacturing, assembly, installation, and identification. Remove all label residue.

2. The Contractor shall clean glass and glazing to a polished condition. Remove substances, which are noticeable on surfaces. Replace any broken glass and damaged transparent materials.

3. The Contractor shall clean stainless steel surfaces (including screens) of all foreign material. Use cleaners as recommended by the manufacturer and approved by SEPTA.

4. The Contractor shall clean existing and new tile surfaces including the grout joints to a dirt- and graffiti-free condition.

E. Equipment and Lighting:

1. The Contractor shall wipe surfaces of all mechanical and electrical equipment including system components to a dirt free condition. Touch up the painted surfaces to match with the overall finish of the equipment/system component.

2. Insure that the equipment and system components are properly identified as required by the Contract Documents, and applicable codes. Confirm that all cover plates are installed properly and locked if applicable. Missing or broken cover plates and those which don't fit and lock properly must be replaced.

END OF SECTION
SECTION 01720 - PROJECT AS-BUILT DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor, throughout progress of the Work, shall maintain an accurate record of changes to the Contract Drawings and Specifications.

B. The Contractor shall at the time of substantial completion, but prior to requesting release of retainage, transfer the changes to a set of Final As-Built Documents, which shall include an As-Built set of Construction Drawings and an annotated set of Specifications.

C. The Contractor shall in addition to the defined requirements to provide paper copies, also provide approved Final As-Built Documents in an electronic format for SEPTA’s future use. The format of these electronic files shall be approved by the SEPTA PM prior to submission.

1.02 RELATED WORK

A. Documents affecting work of this Section include, but are not necessarily limited to, the Agreement and Division 1 of these Specifications.

B. Other requirements affecting Project As-Built Documents may appear in other pertinent sections of these Specifications.

1.03 SUBMITTALS

A. The Contractor shall comply with pertinent provisions of Section 01300.

1.04 QUALITY ASSURANCE

A. Accuracy of Records:

1. The Contractor shall thoroughly coordinate changes within the As-Built Documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other documents where such entry is required to show the change properly.
2. Accuracy of records shall be such that investigations to determine actual installed items may rely reasonably on information obtained from the approved Final Record Documents.

B. The Contractor shall make entries on the As-Built Documents on a weekly basis to include all changes to the Work performed during the last week to confirm they are an accurate representation of the As-Built conditions.

C. The Contractor shall transfer "job set" information to a set of Final As-Built Documents in a neat and professional manner.

1.05 PRODUCT HANDLING

A. The Contractor shall maintain the “job set” of Record Documents completely protected from deterioration and from loss and damage until completion of the Work and transfer of all recorded data to the Final As-Built Documents.

PART 2 - PRODUCTS

2.01 RECORD DOCUMENTS

A. Job Set:

1. Following receipt of SEPTA's Notice to Proceed, the Contractor, shall secure from SEPTA one complete set of all drawings and specifications comprising the Contract Documents. This “job set” will be maintained at the site to record all As-Built changes.

B. Final As-Built Documents: The Final As-Built Documents are to include:

1. Updated As-Builts of the original Contract Drawings.

2. Additional As-Built Drawings as necessary, to describe changes during the Contract period that could not be included on the original contract drawings.

3. Annotated Specifications to include Contract Specifications with all changes made during the Contract period.

4. "As installed" versions of same size drawings of all fabrication, detail, and installation drawings.
PART 3 - EXECUTION

3.01 MAINTENANCE OF JOB SET

A. The Contractor shall, immediately upon receipt of the job set described in Paragraph 2.01, A. above, identify each of the Documents with the title "AS-BUILT DOCUMENTS - JOB SET."

B. Preservation:

1. The Contractor shall devise a suitable method for protecting the As-Built Job Set (job set) in consideration of the Contract duration, the probable number of occasions upon which the job set must be taken out for new entries and for examination; the transfer of information on Final As-Build Documents; and the conditions under which these activities will be performed.

2. The Contractor shall not use the job set for any purpose except entry of new data, for review by SEPTA and for the transfer of data to Final As-Built Documents.

3. Maintain the job set at the site of Work.

C. Making entries on Drawings:

1. The Contractor shall utilize an erasable colored pencil (not ink or indelible pencil) to clearly describe the change by graphic line and note as required.

2. The Contractor shall date all entries.

3. The Contractor shall call attention to the entry by a "cloud" drawn around the area or areas affected.

4. The Contractor shall in the event of overlapping changes, use different colors for the overlapping changes.

D. Revisions:

1. The Contractor shall transfer all changes to respective Specifications and/or Drawings set (if appropriate) immediately, as the change is approved.

2. The Contractor shall make appropriate entries in the drawings as soon as the change is incorporated in the field.
E. Conversion of schematic layouts:

1. The Contract drawings may indicate arrangements of conduits, circuits, piping, ducts, and similar items shown schematically, and is not intended to portray precise physical layout.

   Final physical arrangement is determined by the Contractor, subject to SEPTA's written approval. However, design of future modifications of the facility requires accurate information as to the final physical layout of items, which must be schematically shown on the Final As-Built Drawings.

2. Show on the job set of As-Built Drawings, by dimension accurate to within English Dimensioning Standards, the centerline of each run of items such as are described in subparagraph 3.01E.1 above.
   a. The Contractor shall clearly identify the item by accurate note such as "cast iron drain", "galv. conduit," and the like.
   b. The Contractor shall show, by symbol or note, the vertical location of the item ("under slab," "in ceiling plenum," "exposed," and the like).
   c. The Contractor shall make all identification sufficiently descriptive that it may be related reliably to the Specifications.

3.02 FINAL PROJECT RECORD INFORMATION

A. The purpose of the Final Project As-Built Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modifications of the Work to proceed without lengthy and extensive site measurement, investigation, and examination.

B. Accuracy of Record Data Prior to Transfer:

1. The Contractor is solely responsible for accurate transfer of all field changes and preparing additional reproducible drawings and specification pages.

C. Transfer of Data to Drawings:
1. The Contractor shall carefully transfer change data shown on the job set to the Final As-Built Documents coordinating the changes as required.

2. The Contractor shall clearly indicate at each affected detail and master drawing a full description of changes made during construction, and the actual location of items.

3. The Contractor shall call attention to each entry by drawing a "cloud" around the areas affected.

4. The Contractor shall make changes neatly, consistently, and with the proper media to assure longevity and clear reproduction.

5. The Contractor shall prepare additional reproducible drawings in the same size as the original contract drawings for changes to details (including installation and fabrication drawings) incorporated in the construction that could not be corrected on the As-Built drawings. These drawings shall be adequately identified and cross-referenced with pertinent Drawing(s) to make it part of the Final As-Built Documents.

D. Transfer of Data to Specifications:

1. The Contractor shall accurately and legibly transfer all information from job set to Final Annotated Project Record Specifications Set.

E. Review and Submittal:

1. The Contractor shall submit the completed set of Final As-Built Documents to SEPTA.

2. The Contractor shall participate in review meetings as required.

3. The Contractor shall make required changes and promptly deliver the Final Project As-Built Documents to SEPTA.

4. The Contractor shall sign each sheet of the record drawings, certifying that they are an accurate representation of the As-Built condition.

5. The Final approved set of As-Built Documents shall in conveyed as five (5) paper copies and one (1) copies of the electronic sets.
3.03 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor has no responsibility for recording changes in the Work subsequent to Final Completion, except for changes resulting from work performed under Warranty.

END OF SECTION
SECTION 01830 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 DESCRIPTION

A. Format and Content of Manuals
B. Instruction of SEPTA Personnel
C. Schedule of Submittal

1.02 RELATED WORK

A. Section 01300: Submittals
B. Section 01400: Quality Requirements
C. Section 01410: Testing Laboratory Services
D. Section 01600: Material and Equipment
E. Section 01700: Contract Close Out
F. Section 01720: Project As-Built Documents

1.03 SUBMITTALS

A. Submit operations and maintenance manuals for each machinery and equipment item as follows:

1. One (1) copy of sample format and outline of contents in draft form with the equipment shop drawings.

2. Five (5) copies of complete manual in final form on equipment delivery date for review and comment by SEPTA.

3. Five (5) copies of approved manual after the equipment is installed and ready to test.

4. In addition to the paper copies required elsewhere in this section, all documents, after final approval, will be submitted in an electronic format as approved by the SEPTA PM.
1.04 QUALITY ASSURANCE

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products. Instructions and all O&M data that applies to more than one model of the installed equipment shall be included in an addendum noting all information that applies specifically to the installed model.

B. General Requirements for Manuals:

1. Prepare manuals written in clear grammatical English.

2. Manuals furnished may be manufacturer’s standard publications in regard to size and binding provided they comply with specified requirements relative to quantity and quality of information data.

3. Bind manuals within hard or flexible covers. Make illustrations clear, and printed matter, including dimensions and lettering on drawings, easily legible. If reduced drawings are incorporated into manuals, heavy-up original lines and letters as necessary to retain their legibility after reduction. Larger drawings may be folded into manuals to page size.

C. Prepare manuals using the following materials:

1. Loose leaf, on 60-pound, three-hole-punched paper.

2. Holes reinforced with plastic cloth.

3. Page size, 11 x 8 ½ (if available) or 280 mm x 215 mm.

4. Foldout diagrams and illustrations.

5. Reproducible by dry-copy xerography method.

6. Oil, moisture, and wear-resistant plastic covers.

1.05 FORMAT

A. The Contractor shall prepare data in the form of an instructional manual. Unless otherwise noted in the specifications, a minimum of five copies of the O&M manuals shall be submitted to the SEPTA Project Manager. Clearly identify each manual through the front cover with at least the following information:
B. The Contractor shall prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, subcontractors, and SEPTA Personnel including Operations.
   a. Title page: Include the name and function of the equipment and manufacturers
   b. Table of Contents, in numerical order listing all sections and subsection titles of included diagrams and drawings.
   c. Index, in alphabetical order.
   d. Front piece: Recognition illustration of the equipment described in the O&M Manual.

2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:
   a. Significant design criteria
   b. List of equipment
   c. Parts list for each component including:
      1) Manufacturer’s literature describing each piece of equipment including major assemblies and subassemblies, and giving manufacturer’s model number and drawing number.
      2) “Long-Lead-Time” spare parts list for all spare parts not readily available on the open market or for which it is anticipated ordering and delivery time will exceed 10 days.
3) Complete list of parts and supplies with current unit prices and sources of supply.

4) List of parts and supplies that are either normally furnished at no extra cost with purchase of equipment, or specified herein to be furnished as part of Contract.

5) List of nearest local suppliers for all equipment parts.

d. Operating Instructions:

1) Operation instructions including step-by-step preparation for starting, operation, shutdown and draining, and emergency requirements.

2) Control diagrams, as installed by the manufacturer.

3) Sequence of operation by the control manufacturer.

4) Wiring diagrams as installed by the manufacturer.

5) Diagrammatic location, functions, and tag numbers of each valve.

e. Maintenance instructions for equipment and systems.

1) Maintenance instruction: Include step-by-step procedures for inspection, operation checks, cleaning, lubrication, adjustments, repair, overhaul, disassembly, and reassemble of the equipment for proper operation of the equipment. Include list of special tools, which are required for maintenance with the maintenance information.

2) Possible breakdowns and repairs.

3) Lubrication schedule indicating type and frequency of lubrication.

f. Maintenance instructions for all finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:

a. Shop drawings and product data
b. Air and water balance reports

c. Certificates

d. Photocopies of warranties (and bonds).

e. Appendix: Include safety precautions, a glossary, and, if available at time of submittal, copies of test reports, and other relevant material not specified to be submitted.

1.06 CONTENTS, EACH VOLUME

A. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect/Engineer, Sub-consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. For Each Product or System: List names, addresses and telephone numbers of Sub-contractors and suppliers, including local source of supplies and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Project As-Built Documents shall not be used as maintenance drawings.

E. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer’s instructions specified in Sections 01400, Quality Requirements.

1.07 MANUAL FOR MATERIALS AND FINISHES

A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured Products.

B. Instructions for Care and Maintenance: Include manufacturer’s recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

D. Additional Requirements: As specified in individual Product specification sections.

E. Provide a listing in Table of Contents for design data with tabbed fly sheet and space for insertion of data.

**1.08 MANUAL FOR EQUIPMENT AND SYSTEMS**

A. Each item of Equipment and each system: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications by panelboard label.

B. Include color-coded wiring diagrams as installed.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for trouble-shooting, disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer’s printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer’s parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.
K. Provide Contractor’s coordination drawings, with color-coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer’s spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports as specified in Section 01400 or Division 15 specification.

O. Additional Requirements: As specified in individual Product specification sections.

P. Provide a listing in Table of Contents for design data with index tab sheet and space for insertion of data.

1.09 INSTRUCTION OF SEPTA PERSONNEL

A. Before final inspection, instruct SEPTA-designated personnel in operation, adjustment, and maintenance of products, equipment, and systems at agreed-upon time.

B. For equipment requiring seasonal operation, perform instructions for all seasons.

C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

D. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

END OF SECTION
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SECTION 02010
SUBSURFACE INVESTIGATION

PART 1 GENERAL

1.01 SITE CONDITIONS

A. Soil investigations have been made for SEPTA for this site and the results are as described in Section 02400 – Soils Management. The results of the soils investigations have been provided to the contractor as a courtesy.

1. It is hereby expressly understood by the Contractor that SEPTA, SEPTA’s Project Manager, and SEPTA’s Representatives will not be responsible for any interpretation or conclusions drawn from the previously stated subsurface information.

B. Limitations of Subsurface Information Indicated on Drawings: Certain information regarding the reputed presence, size, character, and location of existing underground structures, pipelines, electrical and signal facilities, and other utilities has been indicated on the Drawings.

1. Accuracy of Location: Underground utility and structure information has been provided based on the most current available information. However, there is no certainty of the accuracy of this information, the location of underground structures indicated may be inaccurate, and other obstructions than those indicated may be encountered.

2. The Contractor hereby distinctly agrees:

a. That neither SEPTA nor SEPTA’s Representatives are responsible for the correctness or sufficiency of the information given.

b. The Contractor will conduct his/her own investigations into existing underground structures and existing utility information within the work areas.

c. The Contractor will verify potential crossing in areas of new utility work and dig test pits as necessary to determine available clearances.

C. Digging Test Pits: In locations where required by SEPTA’s Project Manager, or indicated on the Drawings, dig test pits to determine the location and elevation of existing subsurface utility pipelines, electrical facilities, utilities or structures. Dig such test pits in the presence of an
authorized representative of the owner of the subsurface pipelines, electrical facilities, utilities, or structures.

1. The Contractor is advised that no excavation, pipe laying, or other work is permitted at above referenced locations without the presence or approval of an authorized representative of the owner of the subsurface utility.

2. In locations where new pipelines are to be connected to existing pipelines, the Contractor shall not proceed with new construction until he has dug test pits and determined the exact location and elevation of the existing pipelines. Dig such test pits only at the locations agreed to by SEPTA’s Project Manager.

3. Digging test pits in locations required by SEPTA’s Project Manager or indicated on the Drawings will be classified as Miscellaneous Unclassified Excavation and Backfill.

4. Test pits or other miscellaneous excavation dug to obtain information on subsurface conditions or underground obstructions without written requirement of SEPTA’s Project Manager will be at the Contractor's expense.

1.02 REFERENCES

A. Southeastern Pennsylvania Transportation Authority (SEPTA):


END OF SECTION
SECTION 02050

DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work of this Section consists of demolition, removal, and disposal of existing items on the Contract Drawings and as required to execute the work of this Contract.

B. Work shall be conducted in accordance with the General Conditions, Supplementary Conditions, Division 1, and the requirements of this Section.

C. Related Sections:
   1. Section 02080 – Asbestos Abatement.
   2. Section 02200 – Earthwork.
   3. Section 02210 – Grading.
   5. Section 02270 – Erosion and Sedimentation Control.

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C32, Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
   2. ASTM C33, Standard Specification for Concrete Aggregates.

B. Commonwealth of Pennsylvania Department of Transportation (PENNDOT), Specifications Publication 408, as supplemented.
1. PENNDOT Section 703.3 Select Granular Material (2RC).

C. National Fire Protection Association (NFPA):
   1. NFPA 70 National Electrical Code® (NEC).

D. Southeastern Pennsylvania Transportation Authority (SEPTA).

1.03 QUALITY ASSURANCE

A. Workmen Qualifications: Provide at least one person thoroughly trained and experienced in the skills required and who readily understands the design and is completely familiar with necessary procedures.

B. Regulatory Requirements:
   2. 29 CFR 1910 – Occupational Safety and Health Standards.

C. Other Requirements: The Contractor shall develop a Work Plan for demolition operations to address public (pedestrian and vehicular) safety during work operations. Work Plan must be reviewed and approved by SEPTA Project Manager prior to demolition operations.

D. Safety Meetings: Conduct daily safety meetings.

1.04 SUBMITTALS

A. Documentation
   1. Copy of request to utility companies owning or agency controlling services and appurtenances affected by demolition work for discontinuance of services or relocation of services. Submit copies to the SEPTA Project Manager.

B. Work Plan of proposed procedures for the demolition and removal work. Include a sequence of operations, equipment to be used and name and address of all proposed disposal and recycling facilities.
1.05 PROJECT CONDITIONS

A. Existing Conditions: The information presented on the Drawings is based on visual field examination of the site. While the information provided is believed to be correct, no assurance is implied relative to its total completeness or accuracy. Report discrepancies to the SEPTA Project Manager before disturbing existing installations.

1. The Drawings are intended to indicate the general nature of the demolition work required. Every facility appurtenant to those items designated for removal may not be indicated. Field verify dimensions, quantity, type material, location, means of anchorages and support, interconnection with other facilities, and other pertinent characteristics of facilities which will be removed or demolished to accommodate new facilities.

2. The Contractor hereby distinctly agrees that neither SEPTA nor the SEPTA Representatives are responsible for the correctness or sufficiency of the information given and after the Contractor’s own Site Investigation:
   a. The Contractor shall have no claim for relief from any obligation or responsibility under the Contract with respect to the above stated stipulations.

B. Protection: Exercise care during demolition and removal work to confine demolition operations to facilities as indicated on the Drawings. Physical means and methods used for protection are discretionary; however, assume complete responsibility for replacement and restitution work of whatever nature and at no expense to SEPTA.

1. Additionally, if public safety is endangered during progress of demolition work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways.

2. Signs, signals, and barricades to conform to requirements of Federal, State, and local laws, rules, regulations, precautions, orders, and decrees.

C. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

D. Protect improvements of SEPTA’s property and adjacent properties not identified for removal.

E. Restore damaged improvements to their original condition, as acceptable to property Owners and including soil and debris tracked onto existing paving.
F. Traffic: Conduct site-clearing operations to ensure minimum interference with parking, roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, drive, walks, or other occupied or used facilities without permission from SEPTA or authorities having jurisdiction.

G. Dust Control: To prevent unnecessary spread of dust during performance of the work of this Section, thoroughly moisten surfaces and debris as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other work on the site. Water for use in dust control shall be obtained from Contractor’s own source.

H. Explosives and Blasting: Not allowed in performance of demolition work.

I. Environmental Requirements: Maintain soil erosion and sediment control measures as required in Section 02270.

1.06 SEQUENCING AND SCHEDULING

A. Unfinished Work:

1. Sequence and schedule work with consideration for the stability of the areas of the structure not intended for removal or are intended for removal at a later time.

2. Provide and secure bracing, shoring, or lateral supports to shore unstable areas created as a result of any cutting, removal, or demolition work.

1.07 EXISTING SERVICES

A. General: Indicated locations are approximate; determine exact locations before commencing work.

B. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Notify affected utility companies in advance and obtain approval before starting this Work.

C. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

PART 2 PRODUCTS

2.01 MATERIALS

A. Temporary Materials: Materials needed or required for temporary protection in the form of barricades, fences, enclosures, etc., may be used construction materials of sound condition and reasonably clean. However,
the condition of these materials shall meet or exceed the requirements of
governing agencies or approving bodies as may be involved with the work.

B. Equipment: Equipment, machinery and apparatus (motorized or
otherwise) used to perform the demolition and removal work may be used
as chosen at the Contractor’s discretion, but which will perform the work
within the limits of the Contract requirements.

C. Materials:

1. Select Earth Backfill: On site excavated material free of plant life,
   lumber, metal, refuse and rocks or similar hard objects larger than
   three inches in any dimension.

2. Aggregate Backfill: Conforming to PENNDOT Type 2A Section
   703.2.

3. Sand: Natural or manufactured sand conforming to ASTM C33.

4. Concrete: Class B (3000 psi) as specified in Section 03300.

5. Lean Concrete: 2000 psi compressive strength at 28 days with
   minimum cement content per cubic yard in accordance with current
   ready-mix plant standard practice.
   a. Reduced Aggregate: Aggregate with particle size not less
      than 1/8 inch or more than 1/2 inch in any dimension and a
      maximum of five percent of the particles passing a No. 8
      sieve.

6. Pipe Plug Materials: Where existing storm or sanitary piping is
   being abandoned in place construct pipe plugs in the open ends of
   such pipe using the following materials:
   a. Manhole Brick: Commercially manufactured brick made
      from clay or shale and burned, conforming to ASTM C32,
      Grade MS.
   b. Waterproofed Mortar: Conforming to requirements of ASTM
      C270 for Type M, 2500 psi. Parts by volume include: One
      part cement, 1/4 part lime, and sand at not less than 2¼ or
      more than 3 times the sum of the volumes of cement and
      lime used and of the following materials:
      1) Waterproofing Agent: Medusa Waterproofing Powder
         by Medusa Portland Cement Co.; Hydratite by Grace
         Construction Materials; or Hydrolox by Chem-Master
         Corp. Add the Medusa product in the ratio of two
pounds per bag of cement; add the other products per manufacturer’s recommendations.

2) Portland Cement: Conforming to ASTM C150, Type I.

3) Hydrated Lime: Conforming to ASTM C207, Type S.

4) Sand: Conforming to ASTM C144.

5) Water: Clean and free from deleterious amounts of acids, alkalis, and organic materials.

7. All required plugs, caps, flanges and other items required for disconnected utilities shall be approved by the appropriate utility companies.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS:

A. The means and methods of performing demolition (and removal) operations are the sole responsibility of the Contractor.


3.02 EXAMINATION

A. Field Inspection: Prior to performance of the actual work, carefully inspect the sites of the indicated and annotated demolition work and locate those objects, structures, and partitions designated to be demolished and removed.

1. Verify with the SEPTA Project Manager the objects, structures, and partitions to be demolished and removed.

2. Subsurface conditions.

a. Any available data concerning subsurface materials or conditions has been obtained by the retained Engineer for its own use in designing this project. Its accuracy or completeness is not guaranteed by SEPTA or the SEPTA Project Manager and in no event is it to be considered as part of the contract plans or specifications. Contractors must assume all risks in excavating for this project and shall not be entitled to rely on any subsurface information obtained from the retained Engineer. Bidders shall therefore make their own investigation of existing subsurface conditions and
if they do not do so, the Owner will not be responsible in any way for the consequences.

b. The contract drawings show information obtained by the Engineer regarding the location of pipes, conduits, storm sewers and other structures which exist along the lines of work below the surface of the ground. This information is shown for the convenience of the Contractor who must verify in advance the information given to his own satisfaction. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, notify the SEPTA project Manager immediately. Cooperate with SEPTA and utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner. Do not interrupt existing utilities servicing facilities occupied or those being used except when services have been provided. No extras will be paid for additional utilities encountered or utilities shown in the wrong location.

B. Utilities: Locate existing exposed and buried active utilities and determine the requirement for their protection, or their disposition with respect to the demolition work.

1. Electrical: Disconnect or de-energize on-site electrical wiring close to or entering structures to be demolished. Coordinate with the Electric Company, if necessary, for relocation of utilities.

2. Water: Disconnect or cap on-site water lines close to or entering structures to be demolished. Protect existing fire control hydrants and repair damaged hydrants. Coordinate with the Water Company, if necessary, for relocation of utilities.

3. Natural Gas: Disconnect or cap on-site gas lines and mains close to or entering structures to be demolished. Coordinate with the local gas utility company, if necessary, for relocation of utilities.

4. Sanitary and Storm Sewers: Disconnect or cap sanitary sewers and storm drains close to or exiting structures to be demolished.

5. Coordinate all utility relocations with SEPTA and utility companies. Cap all utilities in a location approved by the SEPTA Project Manager. Use approved cap materials.

C. Exterior Dust Control: To minimize unnecessary spread of dust during performance of exterior demolition work, thoroughly moisten surfaces and debris as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other work on the site. Water
for use in dust control shall be obtained from Contractor's own source and shall be potable water.

D. Protection of Public:

1. If public safety could be endangered during the progress of the demolition work, provide adequate protective measures to protect public pedestrian and vehicular traffic on streets and walkways. The Contractor shall develop a Work Plan for demolition operations to address public (pedestrian and vehicular) safety during work operations. Work Plan must be reviewed and approved by SEPTA Project Manager prior to demolition operations.

2. Signs, signals, and barricades used shall conform to requirements of Federal, State and local laws, rules, regulations, precautions, orders, and decrees.

E. Explosives and Blasting: Not allowed in performance of demolition work.

F. Asbestos: Cease work immediately and notify the SEPTA Project Manager if suspected asbestos is encountered that has not been previously identified.

G. Remediation: Conduct required remediation prior to commencing with work. If contaminated materials are encountered that have not been previously identified, cease work immediately, and notify SEPTA Project Manager.

H. Clearing: Clear vegetation only as necessary to complete work. Additional clearing not required to complete the work shall be as approved by the SEPTA project Manager.

3.03 PERFORMANCE

A. Arrange and pay for disconnecting, removing, capping, and plugging utility services. Notify affected utility companies in advance and obtain approval before starting this Work.

B. Place markers to indicate location of disconnected services. Identify service lines and capping locations on Project Record Documents.

C. General Requirements: The means and methods of performing demolition and removal operations are the sole responsibility of the Contractor. However, equipment used, and methods of demolition and removal will be subject to approval of the SEPTA Project Manager.
1. When removing concrete slabs, saw cut such slabs at the limits of removal to assure a smooth, uniform joint with new concrete installation.

2. Perform removal of masonry and concrete debris, keeping such debris dampened during removal.

D. Excavation and Backfilling: Perform work in accordance with the requirements of Sections 02210, 02222.

1. Should the Contractor, in demolishing or removing existing facilities, such as existing pipelines, excavate below the subgrade for new facilities, he will be required to backfill the area excavated below the subgrade with Aggregate Backfill, at no increase in Contract Price.

2. Backfill substructure cavities using Select Earth Backfill. Restore surfaces in the area of demolished structures to match the surrounding area.

E. Salvage: SEPTA has the right to claim as salvage any of the materials and equipment removed under the work of this Section.

1. Existing removed materials and equipment not claimed as salvage by SEPTA shall become the property of the Contractor and be disposed of in a lawful manner off site.

F. Substructure Penetrations: As a general practice in the demolition work, and to prevent the future accumulation of water in the remaining portions of below grade structures after backfilling operations, break through the bottoms of such structures to the extent that water drainage readily occurs.

G. Abandoned Equipment and Machinery: Existing equipment and machinery in or on the structures, not claimed as salvage by SEPTA, shall also become the property of the Contractor and shall be removed and disposed of in a lawful manner off site.

1. Disposal to be in a State or Federally licensed facility.

2. Contractor shall provide documentation of disposal from facility along with any environmental or hazmat documentation that may be required.

H. Capping Existing Facilities:

1. Cap cut ends of water mains to be abandoned.
2. Close existing corporation stops on water services to be abandoned except those on abandoned mains.

3. Cap ends of gas mains that are to be abandoned.

I. Removal and Filling Existing Valve Boxes:
   1. Remove top section of valve boxes indicated to be abandoned.
   2. Fill with aggregate backfill in layers not to exceed six inches in depth after compaction.
      a. Perform compaction by hand.
      b. Puddling or jetting compacting methods are not permitted.

J. Plugging Existing Pipelines: Provide watertight seals by constructing pipe plugs in the open ends of pipelines being abandoned in place. Use Manhole Brick and Waterproofed Mortar to construct the pipe plugs.

K. Plugging Existing Facilities: Provide watertight seals using Class B concrete. For large openings use Manhole Brick and Waterproofed Mortar.
   1. Plug openings in manholes that are to be abandoned or filled.
   2. Plug the ends of pipe sewers that are to be abandoned or filled.

L. Filling Sewers to be Abandoned: Fill abandoned sewers with Lean Concrete.

M. Structure Foundations: Remove all structure foundations entirely and backfill with Select Earth Backfill.

3.04 REPAIR/RESTORATION

A. General Requirements: At Contractor’s expense, repair or replace damaged structures, appurtenances, and vegetation not specified for removal.

B. Excavation and Fill: Fill pits and voids created by the work in accordance with Section 02200.

3.05 FIELD QUALITY CONTROL

A. SEPTA Project Manager’s Observation: Completely remove demolition debris from the site. Obtain approval from the SEPTA Project Manager prior to commencing with next phase of work.
3.06 CLEANING

A. Debris: Remove or store debris daily to prevent accumulation. Disposal of debris shall be conducted in a lawful manner.

B. Final Cleaning: Clean and restore work areas to the pre-work condition or better.

3.07 PROTECTION

A. Removal: Protect structures, site areas, and vegetation not designated for removal from damage during work.

B. Demolition: Protect existing utilities not scheduled for demolition.

3.08 SITE CLEARING

A. General: Remove grass, and other vegetation, improvements, or obstructions, as required, to permit installation of new construction. Remove similar items elsewhere on site or premises as specifically indicated. Removal includes digging out and off-site disposal of stumps and roots.

B. Clearing and Grubbing: Clear site of trees, shrubs, and other vegetation, except for those indicated to be left standing.

1. Completely remove stumps, roots, and other debris protruding through ground surface.

2. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

3. Place fill material in horizontal layers not exceeding 6 inches loose depth and thoroughly compact each layer to a density of 100 percent of the maximum dry density under walkway and pavement footprints and do not compact in planting areas.

C. Demolition and Removal of Improvements: Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.

1. Saw cut edges of existing bituminous and concrete paving to be removed. Saw cuts are to be straight and clean.

2. Demolish and remove all indicated existing site structures, such as footings, curbs, and foundation walls, completely.
3. Demolish and remove all indicated existing walks completely to subgrade.

4. Demolish and remove all indicated bituminous concrete paving and curbs completely to subgrade.

D. Abandonment or removal of certain underground pipe or conduits is indicated on demolition and site preparation plan. Remove abandoned underground piping or conduits interfering with construction as indicated on the plans.

END OF SECTION
SECTION 02055
ABANDONED SEPTIC TANK

PART 1 GENERAL

1.01 SUMMARY

A. The work specified in this section consists of uncovering, pumping, demolition or removal, and backfilling existing septic tanks.

B. Related Work Specified Elsewhere:

1. Section 01060 – Regulatory Requirements and Safety.
2. Section 01300 – Submittals.
3. Section 02050 – Demolition.
4. Section 02220 – Grading, Excavation and Backfill.
5. Section 02500 – Paving and Surfacing.
7. Section 02160 – Excavation Support and Protection.
8. Section 02190 – Site Monitoring.

1.02 JOB CONDITIONS

A. Barricade open excavations and post with warning lights those excavations occurring on property adjacent to or within public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation and backfill operations.

C. Existing underground facilities: Indicated locations of known existing facilities and systems are approximate. Investigate and determine exact locations and natures of facilities and systems, and accept sole responsibility for damages thereto caused by construction activities. Before excavating in the vicinity of underground utilities, notify the appropriate jurisdiction or utility as specified in Section 01060. SEPTA
does not guarantee that all facilities and systems, which may exist before the work begins, are indicated. Comply with PA Act 287 and all amendments (PA One-Call System).

D. Preserve, protect, and maintain existing operable drains and sewers.

E. Keep excavations dry.

F. Use of explosives is prohibited.

G. Toxic and Combustible Substances:

1. During excavation, provide equipment and carry out such tests as necessary to detect presence of toxic and combustible substances.

2. If the presence of noxious or explosive gas is indicated, immediately discontinue excavation operations and notify the SEPTA Project Manager. Do not resume work at said locations until the necessary safety measures have been taken and further tests indicate the absence of any noxious or explosive gases.

3. Take action to safeguard persons and property in accordance with rules and regulations of jurisdictional agencies and utility owners.

4. Promptly notify utility owners when problems concerning their facilities become apparent.

PART 2 PRODUCTS

2.01 CRUSHED AGGREGATE

A. No. 2A, Coarse Aggregate; PENNDOT Specifications *Publication No. 408*, Section 703, latest edition and all supplements

2.02 SOURCE OF MATERIALS

A. To the extent that it is available, obtain material from excavation operations. If sufficient satisfactory materials are not available to meet fill and backfill requirements, obtain material meeting specified requirements for satisfactory soil material from outside sources at no additional cost to SEPTA.

B. Earth excavation may contain excess moisture in its natural state or may take on excess moisture during handling and stockpiling. Manipulation to dry material to proper moisture content prior to compaction may be necessary. Earth excavation will not be considered as unacceptable backfill material by virtue of its moisture content only.
C. Use only material whose quality, source, and zone of placement in the fill have been approved.

D. Equipment: Equipment, machinery, and apparatus (motorized or otherwise) used to perform the demolition and removal work may be used as chosen at the Contractor’s discretion, but will perform the work within the limits of the Contract requirements.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Field Inspection: Prior to performance of the actual work, carefully inspect the entire site and locate those facilities designated to be abandoned or removed, as indicated on the Drawings.

1. Do not begin work of this Section without approval to do so by the Engineer.

B. Existing Utility Locations: Locate existing exposed and buried active utilities and determine the requirements for their protection.

3.02 PUMPING AND REMOVING

A. General Requirements: The means and methods of performing the demolition work, and the materials and equipment removal operations are the sole responsibility of the Contractor. However, equipment used and methods of demolition and removal will be subject to approval of the Engineer.

B. Pumping of Septic Tanks and Disposal of Waste

1. Pump septic tanks prior to tank demolition or removal, using a commercial firm possessing a valid license for such work. Dispose of wastes at a State approved disposal site.

C. Demolition of Tanks

1. Demolition of Tanks. Open top of tank sufficiently to allow complete backfilling of the tank interior. Break a minimum of 3 holes, 6 inches in least dimension, in the bottom of each compartment of the tank prior to backfilling. Remove any portion of the tank within 12 inches of the finish grade. Remove tank components from work site within 24 hours of removal.
D. Debris Removal: Dispose of demolition debris not used in backfilling off site in a lawful manner. Containerize or otherwise store debris as work is in progress.

3.03 BACKFILLING

A. General Requirements: Perform backfilling in the area of abandoned septic tanks in accordance with Section 02220.

1. Fill the Septic Tank chamber and cavities in layers not exceeding one foot of compacted thickness using Coarse Aggregate No. 2A.

2. Restore the surface over the tank and the surrounding area at subgrade elevations for paving operations.
SECTION 02080

ASBESTOS ABATEMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. Work Included: Work of this Section generally comprises the removal and disposal of interior ceiling and exterior soffit material, which contains 25% chrysotile asbestos from the Levittown Station.

B. Related Work Specified Elsewhere:

1. Section 02050: Building Demolition.

C. Work shall consist of, but not necessarily be limited to, the following:

1. Remove asbestos-containing transite ceiling material (Category II, non-friable asbestos-containing material).

2. Dispose of ceiling material at a disposal site which is licensed to accept Category II, non-friable, asbestos-containing material.

D. Work specified herein shall be undertaken by competent persons trained, knowledgeable, and qualified in asbestos removal techniques and in handling and disposal of asbestos-containing and contaminated materials, all in compliance with applicable regulatory requirements. Asbestos abatement contractors and individuals performing asbestos abatement in the Commonwealth of Pennsylvania must be certified by the Pennsylvania Department of Labor and Industry.

1.02 JOB CONDITIONS

A. General: Inspect conditions at each location where work of this Section will be performed. Take note of all conditions that will affect the execution of the work, including, but not limited to, existing dimensions, clearances, access, protection required, and all other pertinent factors.

B. Stage and sequence work in conformance with the Construction Schedule and Construction Phasing Plan. Contractor is advised that the Levittown Station is an active train station that is active seven (7) days per week.

C. In its present state, the ceiling material is a Category II, non-friable, asbestos-containing material in good condition.

D. Contractor shall provide any additional or temporary lighting required throughout the project.
1.03 DEFINITIONS

A. Amended Water: Water to which a surfactant has been added.

B. Authorized Visitor: SEPTA or its representatives and any representative of regulatory agency having project jurisdiction.

C. Contractor: The individual and/or business under contract with SEPTA.

D. Equipment Decontamination System: Facilities designed for controlled transfer of material, equipment, and tools into or out of work area.

E. Fixed Object: Equipment or furniture in work area which cannot be removed.

F. HEPA Filter: A high efficiency particulate air filter capable of removing particles with a nominal aerodynamic diameter of 0.3 micrometers with 99.97% efficiency.

G. Moveable Object: Includes, but not limited to, blinds, screens, grilles, access panels, trim pieces, equipment and furniture in work area which can be removed; includes detachable electrical, lighting, heating and ventilation equipment and other items secured to surfaces from which asbestos-containing material shall be removed.

H. Sealant: A viscous liquid recommended by USEPA applied to asbestos-containing materials to control the release of airborne fibers.

I. Worker Decontamination System: Facilities for storing street clothes, cleaning protective equipment, showering and storing contaminated clothing.

1.04 REGULATIONS, STANDARDS, AND CODES

A. General Requirements

1. Work shall be undertaken in accordance with applicable federal, state, and local regulations, standards, codes, and guidelines.

2. The most recent edition of regulations, standards, codes, and guidelines shall be in effect. Contractor shall have copies available at work site. Where conflict among the regulations, standards, codes and guidelines and these specifications exists, the more stringent requirement shall govern.

3. Contractor shall be solely responsible for supervising, directing and controlling work under this contract; for the means, methods, techniques and procedures for asbestos removal, and the handling
of asbestos-containing and contaminated materials; for disposing of asbestos-containing and contaminated materials at a permitted site; and for safety precautions and programs incidental to the work.

B. Federal and State References

1. Title 40 Code of Federal Regulations:
   b. Parts 141 and 142, Safe Drinking Water Act.

2. Title 29 Code of Federal Regulations: Section 1926, Safety and Health Regulations for Construction and Section 1910, Safety and Health Regulation for General Industry, as applicable.


5. ASTM International (ASTM):

6. Commonwealth of Pennsylvania:
   c. Department of Labor and Industry: Worker and Community Right-to-Know Act 1984-159.
   d. Pennsylvania Department of Environmental Protection: Act 97, the Solid Waste Management Act of July 7, 1980.

7. Local regulations, standards, and codes.

1.05 PERMITS
A. Procure and pay for required permits governing work of this Section.

1.06 SUBMITTALS
A. Within three (3) days after the selection of the apparent successful bidder, the apparent successful bidder shall submit to the Project Manager the following data:

1. Superintendent’s qualifications and certification number as required by applicable laws and regulations.

2. Project schedule for each building work area showing, as a minimum, the dates for set-up, initial inspection, removal, removal inspection, cleaning, and re-establishment of objects and systems. Contractor will adjust the schedule as necessary to complete work within contract time and submit revised copies to Project Manager.

3. A description of the means, methods, techniques and procedures to be used for ceiling material removal, including:
   a. Work area isolation.
   b. Interior ceiling and exterior soffit removal procedures, including means of access.
   c. Procedures to be followed to maintain roofing material as Category II, non-friable asbestos containing material during removal, waste load out, transport, and disposal.
   d. On-site handling and storage of asbestos-containing and contaminated material.
   e. Work area clean-up.
   f. Worker protection and air monitoring.

4. If means, methods, techniques, and procedures established by Contractor must be changed, Contractor shall in writing notify the SEPTA Project Manager and appropriate regulatory agencies of alternate to be utilized.
5. A statement signed by each removal worker acknowledging that each worker has received instruction pertaining to asbestos hazards, use and fitting of respirators, use of protective equipment, decontamination procedures, and additional project-related personal protective procedures and measures, and certification numbers as required by laws and regulations.

6. Material Safety Data Sheet (OSHA Form 20) and manufacturer’s specifications for solvents, surfactant, substrate sealant and penetrant/fiber encapsulant.

7. Solid Waste Permit for asbestos disposal at DEP-approved landfill.

B. Not later than ten (10) working days prior to commencing work, submit required written notifications to the Pennsylvania Department of Environmental Protection, Pennsylvania Department of Labor and Industry, U.S. Environmental Protection Agency. Provide copies of such notifications to SEPTA Project Manager.

1.07 CERTIFICATIONS AND AGREEMENTS

A. Contractor shall visit the site prior to bidding to verify the location of materials to be removed, and may review bulk sample results to the extent available. Bid submission constitutes agreement by the Contractor that this requirement has been complied with and that sufficient information is available to properly bid the project.

B. Contractor and SEPTA shall agree in writing on the condition of the building and fixtures prior to commencement of the work.

C. Contractor shall furnish a competent full-time superintendent who will be responsible for supervising, directing, and controlling work under this contract; for the means, methods, techniques, and procedures for asbestos removal, and the handling of asbestos-containing and contaminated materials; and for safety precautions and programs incident to the work. The Superintendent shall be accredited in accordance with applicable laws and regulations.

1.08 BUILDING OWNER RESPONSIBILITIES

A. SEPTA shall provide access to buildings and work areas. Contractor shall notify Project Manager prior to working night, weekend, or holiday hours.

B. SEPTA shall provide personnel to instruct Contractor in use of SEPTA’s mechanical/electrical systems.
C. SEPTA shall provide electrical power and water as needed for completion of this Contract. Contractor shall provide temporary connections to systems as needed.

1.09 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Construction requirements of Federal, State, County, or local authorities exceeding the requirements of the codes, standards and approving bodies referenced herein shall be met.

B. Certificates and Permits: Upon completion of work, and prior to final payment, furnish formal certification of final inspections to SEPTA Project Manager from authorities having jurisdiction and secure required permits, if any, from same. Additionally, prepare detailed diagrams and drawings which may be required by those authorities having jurisdiction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Furnish materials necessary for performing the work.

2.02 TOOLS AND EQUIPMENT

A. Provide tools and equipment necessary for performing the work.

PART 3 EXECUTION

3.01 GENERAL

A. Prior to commencement of roofing material removal, Contractor shall submit a ceiling material removal plan to the SEPTA Project Manager showing proposed sequence of operations and means and methods.

B. Protect and be responsible for adjacent portions of the facilities and track.

C. Shut down electric power in wet work areas. Provide temporary power and lighting per code requirements and provide ground-fault interrupter circuits as power source for electrical equipment.

D. Isolate work area and establish emergency exits.

E. Remove moveable objects to a temporary storage location identified by SEPTA Project Manager.

F. Cover fixed objects where appropriate.
G. Establish procedures for on-site handling and storing of asbestos-containing and contaminated materials.

H. Damage or disturbance, or other impairment of existing facilities shall be promptly repaired, restored, or replaced by Contractor as approved by the Project Manager and at no additional cost to SEPTA.

I. If unforeseen obstructions are encountered, take precautions necessary to prevent damage and obtain instructions from SEPTA Project Manager before proceeding with work.

3.02 DELIVERY AND STORAGE

A. Deliver materials to the job in original, new and unopened packages and containers bearing manufacturer’s name and label, and the following information:

1. Name or Title or Material Manufacturer’s stock number and date of manufacture.
   a. Manufacturer’s name.
   b. Thinning instructions.
   c. Application instructions.

B. Deliver materials together with a copy of OSHA Material Safety Data Sheet for material.

C. Materials shall be stored out of weather, in original tightly sealed containers.

D. Performance Guarantee: Submit manufacturer’s performance guarantee and length of guarantee.

3.03 SITE PREPARATION

A. Contractor shall verify the following with Project Manager:

1. Vehicle access and parking.

2. Storage, field office and decontamination system locations.

3. Work area access including doors, stairways, corridors and elevators.

4. Availability of building utility services and toilet facilities.

5. Temporary storage space.
6. Scheduled building occupancy activities.
7. Building equipment and utility service shutdown and reactivation requirements and schedules.
8. Security, fire safety and emergency measures and procedures.

3.04 ASBESTOS REMOVAL

A. Protect building items remaining in work areas from damage during work of this Section.
B. Wetting of material prior to removal of transite ceiling and soffit material to reduce visible dust while removal work is in progress.
C. Engineering controls are used to prevent the emissions of visible dust from the removal operation.
D. Removal methods must comply with requirements to adequately wet the ceiling material and discharge no visible emissions as required by law.
E. Ceiling material shall be kept wet during demolition and removal. Wet with amended water each section of ceiling immediately prior to removal. Mechanized or manual spraying may be used.
F. Collect any asbestos-containing ceiling material (ACCM) dust or debris generated by the removal activities, using a HEPA-filtered vacuum cleaner. Spray penetrating sealant into each section to be removed. This spraying follows before and after debris vacuuming described.
G. Use encapsulant to capture dust and broken raw edges of potentially broken-up segments of ACCM. These broken segments will be place in lined waste containers while its edges are still wet from the encapsulant. Other ACCM related debris will be wetted and placed in waste containers or bagged for waste load out.
H. A remote personnel and equipment decontamination station shall be installed and used.

3.05 AIR SAMPLING AND ANALYSES

A. Air sampling and analysis may be undertaken prior to and throughout the removal and cleanup activities, and at the conclusion of final cleanup and will be subject to the most stringent applicable federal, state and local rules and regulations.
B. Contractor Responsibility:
1. Undertake work area air sampling and analysis to establish worker exposure. Air sample analysis must be performed by a laboratory accredited by the American Industrial Hygiene Association utilizing methods set forth in 29 CFR 1926.1101, Appendix A. If airborne fiber concentrations exceed regulatory limits, Contractor shall advise workers and SEPTA Project Manager, and immediately discontinue work until the cause is identified and corrected. The use of a continuous reading fiber monitor will not relieve the Contractor of the responsibility to comply with regulatory requirements.

2. Furnish SEPTA Project Manager with copies of laboratory analytical reports.

C. SEPTA Responsibility:

1. Prior to and throughout removal and cleanup work, air sampling may be conducted within and outside of the affected work areas. If fiber concentrations exceed 0.01 fibers/cc by phase contrast microscopy in any of the samples, Project Manager will notify Contractor’s superintendent. Superintendent shall immediately determine the cause of excess fiber count and undertake corrective action. Work shall not recommence until the source of contamination has been identified and additional samples have been collected indicating airborne fiber concentrations are below 0.01 fibers/cc or the background level.

2. Conduct periodic inspections and final inspection.

3.06 PERSONNEL PROTECTION

A. Worker protection procedures and measures are sole responsibility of Contractor.

B. At all times Contractor shall utilize personnel protection procedures and measures commensurate with job conditions.

C. The Contractor shall be prepared to provide authorized visitors with suitable protective clothing and equipment whenever they desire to enter the work area. The Contractor shall require that persons entering work are said clothing and equipment, and refuse entry to those who do not comply. Contractor shall also make available to authorized visitors the use of worker decontamination facilities.

3.07 WORKER AND EQUIPMENT DECONTAMINATION SYSTEMS

A. Contractor will be responsible for providing separate worker and equipment decontamination systems. The systems will be designed by
the Contractor to minimize fiber or air transfer between work area and decontamination systems, and building areas outside work area and decontamination systems. Wastewater shall be pre-treated to the extent required by local municipal ordinance prior to discharge to the sewerage system, or other suitable arrangements made for its containment and disposal.

3.08 REMOVAL INSPECTION

A. SEPTA may conduct periodic inspections of the work area.
B. Contractor shall provide access equipment required for inspections.
C. Contractor’s superintendent shall accompany SEPTA Project Manager on inspection and Contractor shall immediately undertake corrective action as directed by SEPTA Project Manager.
D. Twenty-four (24) hours prior to completion of removal work, notify Project Manager so that a final inspection of removal work may be scheduled. Contractor’s superintendent shall have first inspected work area to ensure removal is complete. Prior to final inspection, all waste and debris from removal shall have been removed from work area.

3.09 RE-ESTABLISHMENT OF SYSTEMS

A. After final inspection results are accepted by SEPTA, Contractor shall:
   1. Remove decontamination systems and work-related materials, tools and equipment.
   2. Replace moveable objects.
   3. Repair work-related damage including tape residue or adhesive damage.
   4. Undertake final cleaning of the work area using HEPA filtered vacuum equipment and/or wet methods as appropriate.
B. Advise SEPTA upon completion so that a final inspection may be scheduled. Contractor’s superintendent shall accompany SEPTA on the inspection and immediately undertake corrective action as directed by SEPTA.

3.10 DISPOSAL PROCEDURES

A. ACCM soffit material shall be maintained in a non-friable state during transport and disposal.
B. ACCM shall be transported to a disposal site that is permitted to accept Category II, non-friable, asbestos-containing materials. Vehicles used to transport materials shall be fully enclosed or covered.

C. Copies of manifests shall be forwarded to Project Manager.

END OF SECTION
SECTION 02160
EXCAVATION SUPPORT AND PROTECTION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work of this section shall consist of the designing, providing, maintaining, and subsequently removing to the extent indicated, of an excavation support system as required to retain earth excavations and embankments in a manner which shall permit the safe and expeditious construction of the permanent structures and utilities and prevent lateral displacement or settlement of adjacent building, structures, and utilities.

B. The support system may include steel sheet piling, underpinning, or other methods as approved by Amtrak and SEPTA, and may be secured in place by shoring, walls, struts, tieback anchors, or other similar means suitable for the site conditions and adjacent structures.

C. Related Sections:
   1. Section 02010 – Subsurface Investigation.
   2. Section 02190 – Site Monitoring.
   4. Section 02261A – Requirements for Temporary Sheeting and Shoring to Support Amtrak Tracks.

1.02 REFERENCES

A. Reference Publications are referred to be abbreviation as follows:
   1. American Concrete Institute (ACI):
      a. ACI 301, Specifications for Structural Concrete.
      b. ACI 305, Hot Weather Concreting.
   3. ASTM International (ASTM):
b. ASTM A328, Standard Specification for Steel Sheet Piling.

c. ASTM A416, Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

d. ASTM A421, Standard Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete.

e. ASTM A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

f. ASTM A722, Standard Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete.

g. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft$^3$ (600 kN-m/m$^3$)).

4. American Wood Preservers’ Association (AWPA):

   a. AWPA C2, Lumber, Timber, Bridge Ties and Mine Ties – Preservative Treatment by Pressure Processes.

5. U.S. Army Corps of Engineers (USACE).

   a. USACE CRD-C621, Specification for Non-Shrink Grout.

1.03 QUALITY ASSURANCE

A. Excavation support work shall be performed by a firm having a minimum of 10 years of experience in related work and having successfully completed work on a minimum of two project of a similar nature within the past 5 years.

B. All excavation support system work shall be under the direct supervision of a qualified professional engineer having a minimum of 5 years experience in similar work. Direct field superintendents shall have a minimum of 5 years experience in similar work.

C. The support system shall be designed to support earth pressures, utility and equipment loads, construction loads, railroad loads, and other surcharge loads as applicable. Provide shoring, bracing, cribbing, underpinning, and sheeting in accordance with SEPTA - ROW Design and Construction Standards and Section 02261A.

D. Drawings and calculations shall be stamped and signed by a professional engineer registered in the Commonwealth of Pennsylvania.
E. Comply with local codes and ordinances of governing authorities having jurisdiction.

1.04 SUBMITTALS:

A. Provide the following in a timely manner in accordance with the approved submittals schedule as specified in Section 01401-General Requirements.

B. Submit to Amtrak for review in accordance with Section 01100.

1.05 SUBMITTAL: EXCAVATION SUPPORT SYSTEM SHOP DRAWINGS

A. Shop drawings of the excavation support system which shall include the following information:

1. Layout drawings of proposed work.


3. Method of operation and installation, test procedures, and components to be left in place.

4. Detailed schedule of proposed construction operations

5. Method for monitoring movement of existing structures and tracks.

6. Record of experience.

B. Complete design calculations, clearly referenced to the drawings and easy to review. Calculations shall include all design loads and the maximum theoretical deflections of support members.

PART 2 PRODUCTS

2.01 PRODUCTS

A. General: All materials shall be of the size, shape, and properties suitable for supporting the loads imposed. Materials need not be new, but shall be in serviceable condition.

B. Steel Sheet Piling: ASTM A328 or ASTM A572.

C. Concrete:

1. Concrete work shall meet applicable requirements for ACI 301 "specification for structural concrete for buildings,” except as modified by the supplemental requirements specified in this section. Numbers in parentheses refer to ACI 301 paragraphs.
a. (3.2) The 28-day compressive strength of concrete for underpinning or encasement of soldier beams shall be 4,000 pounds per square inch. Lean concrete shall have a 28-day compressive strength of 1,500 pounds per square inch.

b. (3.7.1) Calcium chloride shall not be used. Chloride ions in admixtures shall not exceed 0.1 percent by weight of cement content.

c. (12.3) The recommendations of ACI 305 “Hot Weather Concreting,” and ACI 306 “Cold Weather Concreting” are made a part of this specification.

2. Non-shrink grout shall meet the requirements of the Corps of Engineers’ specification CRD-C621 for non-shrink grout.

D. Structural Steel: Structural steel, including braces, struts, walls, and stiffener plates, shall meet requirements of ASTM A36 and AISC “Specification for Structural Steel Buildings.”

E. Tieback tendons shall be fabricated from single or multiple elements meeting the requirements of the following standards:


F. Timber Lagging: Preservative treated timber lagging shall be treated in accordance with AWPA C2 and shall be of a structural grade providing a minimum allowable bending of 1,100 pounds per square inch.

PART 3 EXECUTION

3.01 SITE CONDITIONS

A. Monitor adjacent tracks and structures in accordance with Section 02190, Section 02261A, and SEPTA – ROW Design and Construction Standards. Provide a contingency plan to be implemented if unfavorable performance is evidenced.

B. Protect existing active sewer, water, gas, electricity, and other utility services and structures. Comply with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuation of services, as affected by this work.

C. Sheeting, Shoring, and Bracing
1. The Contractor shall adhere to the requirements for sheeting and shoring as defined in the SEPTA – ROW Design and Construction Standards and specification Section 02261A – Requirements for Temporary Sheetin... Amtrak tracks. The most stringent requirements shall govern.

2. Protect the site from caving and detrimental soil movement.

3. The bottom of the support system shall be carried to a depth below the main excavation adequate to prevent lateral movement. In areas where additional excavation is required below the main excavation sub grade, provision shall be made to minimize movement of the main excavation supports.

4. Sheeting, shoring, and bracing systems retaining earth on which the support or stability of existing structures is dependent shall be left in place at completion of work. Leave components in place as indicated on the shop drawings.

5. Locate sheeting, shoring, and bracing to clear permanent work and to permit forming and finishing of concrete surfaces and installation of utilities. If necessary to move a brace, install new, comparable bracing prior to removal of original brace.

6. Do not place sheeting, shoring, or bracing where it will be cast into or included in permanent concrete work except as otherwise indicated or approved.

7. Install internal bracing, if required, to prevent spreading or distortion to braced frames.

8. Maintain bracing until structural elements are rebraced by other bracing or until permanent construction is sufficiently constructed to withstand imposed earth and hydrostatic loads.

9. The contractor shall have a sufficient quantity of material at the site at all times for sheeting, shoring, bracing, and other purposes for the protection of the work and for use in case of accident or other emergency.

D. Lean concrete shall be placed in such a number as to present a firm, stable mass capable of retaining shape and position during excavation operations.

E. Tiebacks:
1. The unbonded length and bonded length shall be as shown on the excavation support system shop drawings, but in no case shall the total anchor length be less than 35 feet.

2. Test loads and anchorage hardware shall be in conformance with manufacturer’s recommendations.

3. Test each tieback to 130 percent of design load.

F. Underpinning:

1. Provide underpinning of adjacent structures as required to avoid undermining structures during excavation.

2. The length of an individual underpinning pit shall not be more than 5 feet depending upon the type of existing footing. The design shall show that the underpinning provides adequate bearing for existing building loads. No two adjacent pits shall be excavated simultaneously and at least 8 feet of undisturbed bearing shall remain between pits being excavated concurrently.

3. The pits shall be filled with concrete leaving a 2-inch space between the top of the underpinning and the bottom of the existing foundation. The next day the space shall be completely filled with non-shrink grout. Load transfer shall occur after mortar or grout has set.

4. The design shall consider the earth loads acting on the underpinning and provide tiebacks or braces as required to resist these loads and minimize deflection.

G. Removal of Support System

1. Remove all support systems prior to placement of backfill. Where the support of excavation system is removed, wholly or in part, the removal shall be performed in a manner that will not disturb or damage adjacent buildings, structures, construction, or utilities. All voids shall be immediately filled with lean concrete or with an approved backfill compacted to density equal to 100 percent of the density at optimum moisture content as determined by ASTM D698.

2. All material removed from the supporting system shall be immediately removed from the site.

3. The contractor shall repair all damage, which results from removal of the supporting system.

END OF SECTION
SECTION 02190
SITE MONITORING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the furnishing, installing, monitoring, maintaining, and removing of a monitoring system for detection of ground movements and for detection of movements of existing facilities resulting from construction activities including, but not limited to, installation of excavation support and protection systems, installation of micropiles.

B. This section specifies the requirements for monitoring during construction. All track monitoring must be performed in accordance with Amtrak requirements and as specified herein.

C. The SEPTA and Amtrak require that the tracks be maintained at all times within established criteria for the specific track classification. Deficiencies in track surface and alignment caused by construction activities shall be corrected solely by SEPTA and Amtrak forces at the expense of the Contractor. At the completion of the project the requirement for tamping and realigning the tracks, caused by the settlement from the construction activity, remains with the Contractor for the duration as specified by the SEPTA and Amtrak in their initial review of the work plans.

D. The Contractor’s monitoring specialist must be responsible for purchasing, installing, and obtaining data for the monitoring system. The Contractor must be responsible for providing access to monitoring locations throughout construction.

Success of the monitoring effort will require close cooperation between the Contractor and its Subcontractors and the field instrumentation specialist. Prior to start of the construction, the monitoring specialist must meet with the Contractor and its Subcontractors so that all parties understand the nature and extent of the monitoring program. The Contractor and its Subcontractors must cooperate with the monitoring specialist by providing access to monitoring locations and by preventing damage to monitoring points during construction. If such damage occurs, the Contractor must pay for the instruments to be replaced.

E. Related Sections:

1. Section 02160 – Excavation Support and Protection.

2. Section 02200 – Excavation, Backfill, and Compaction.
3. Section 02261A – Amtrak Requirements for Temporary Sheeting and Shoring to Support Amtrak Tracks.

4. Section 02455 – Micropiles.

F. Description of Monitoring Points:

1. Cased deep benchmarks are benchmarks founded at an elevation below the bottom of the excavation and which are isolated from the surrounding soil by an outer casing. Cased deep benchmarks are used as control benchmarks for determining the elevation of all other instruments.

2. Surface settlement points are markers placed on structures. Surface settlement markers are monitored by optical survey methods to determine vertical displacements during construction.

3. Track movement points are markers placed on tracks. Track movement points are monitored by optical survey methods to determine vertical and horizontal displacements during construction.

G. Monitoring is defined as the survey of monitoring points at specified time intervals and subsequently performing calculations including change of data since initial and previous readings, plotting readings, and submitting the readings, calculations, and plots to the Engineer.

Survey control is defined as a system of precise field measurements of the types and kinds specified, utilizing suitable methods and equipment and utilizing qualified personnel, for determination of elevations, coordinates and distances for the prosecution of the work.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. Amtrak Engineering, Track Monitoring. As attached.

B. Qualifications of Personnel:

1. Monitoring Specialist: The Contractor must employ the services of a qualified monitoring specialist. Perform instrument installation and monitoring work under the direct supervision of the monitoring specialist. The monitoring specialist must be a registered professional engineer or a registered professional geologist having recent experience acceptable to the Engineer in the design, installation, and monitoring of instrumentation similar to types specified. Persons not meeting the registered professional
engineer or geologist requirement will be considered on the basis of extensive experience and technical knowledge as demonstrated by resumes, personal interviews and if that person is supervised by a professional engineer or geologist. The Engineer reserves the right to reject any person deemed to be insufficiently qualified.

a. Employ qualified technicians with experience in performing control surveying of the type specified.

b. Employ a licensed Land Surveyor, registered in the Commonwealth of Pennsylvania, thoroughly experienced in survey control of type specified, to supervise and direct survey-control technicians and to be responsible for survey control.

C. Tolerances:

1. Establish the coordinates of survey-control monuments to 0.001 foot.

2. Establish the coordinates of survey-control baseline traverse points to 0.001 foot.

3. Establish the elevation of cased deep benchmarks to 0.001 foot.

4. Establish the initial elevation of surface settlement points to 0.001 foot.

5. Establish the initial elevation and horizontal location of track movement points to 0.001 foot.

6. Establish the initial coordinates of all other instruments to 0.1 foot.

7. Record the subsequent elevations of surface settlement points to 0.005 foot.

8. Record the subsequent elevations and horizontal location of track movement points to 0.005 foot.

D. Perform work under a Quality Assurance/Quality Control (QA/QC) Plan that includes calibration of monitoring equipment, inspection procedures for individual monitoring points and periodic inspection that the system is working and providing accurate data.
1.03 SUBMITTALS

A. Prior to proceeding with the work, submit the following to the Engineer and to Amtrak. The proposed monitoring plan must be approved by the Amtrak prior to starting the work.

1. Qualifications of personnel specified in Article 1.02 herein.

2. Locations of cased deep benchmarks, surface settlement points and track movement points.

3. Schedule and detailed procedures: Proposed schedule and procedures for installing and monitoring all instruments and performing the other work of this section.

4. QA/QC Plan as specified in Article 1.02 herein.

B. Monitoring Data:

1. Three copies of original field notes and data, on forms approved by the Engineer, without delay during the working shift in which observations have been made.

2. Reduced notes within 24 hours after observations have been made.

3. Immediate report of movements detected.

4. Graphical plots, on forms approved by the Engineer, of all movement data within 24 hours after observations have been made.

C. Daily Logs: A daily log of major construction events and observations on forms approved by the Engineer. Include in the daily log at least the following:

1. Detailed excavation and construction records for Excavation Support and Protection Structures.

2. Incidence of excessive ground loss through the excavation support wall, boulders, groundwater flow, instability, or other unusual events.

3. Construction loading in the vicinity of instrumentation.

4. Date, time, weather conditions, and temperature.

5. Track number, compass direction, station number, base reading (with date), static elevation, change in elevation or alignment.
(recorded in hundredths and in inches), dynamic reading, and total deflection in inches.

D. Survey Notes: Copy of original field notes of survey-control surveying.

E. Working Drawings: Working drawings and reports summarizing instrumentation installations.

F. Contingency Plans: Submit contingency plans to stabilize soil, tracks, and/or structures affected by the adverse movements detected by the instrumentation. Submit contingency plans at least 1 month prior to start of excavation work. At a minimum, include the following:

1. Name(s), telephone number(s), and location(s) of person(s) responsible for implementation of contingency plans.

2. Materials, equipment and supplies required to implement contingency plans.

3. Location at the work site of all necessary materials, equipment, and supplies required to implement the contingency plans.

4. Each type of anticipated remedial method proposed to stabilize soil and/or track movements. Include basis for determining proposed actions.

5. Step-by-step procedure for performing work involved with contingency plans.


1.04 REFERENCES

A. ASTM International (ASTM):


1.05 JOB CONDITIONS

A. Availability of Data

1. Do not disclose monitoring data to third parties and do not publish monitoring data without the prior approval of SEPTA.

2. The Contractor will interpret monitoring data and will make such interpretations available to the Engineer.
3. The Contractor may observe the readings at any time, or take supplementary readings at no additional cost to SEPTA. All data collected by the Contractor must be made available to the Engineer.

B. Access to monitoring points: Provide and facilitate access to monitoring points for the Engineer. Access may be temporarily obstructed on a non-regular basis not to exceed the duration of one working shift.

C. All monitoring will be performed by the Contractor.

D. Stockpile ten (10) tons of approved ballast at the project site, and maintain that amount in ready reserve, to allow for the possible need to restore track profile.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cased Deep Benchmarks:
   2. Read point consisting of two-inch diameter ball fabricated from approved grade of stainless steel.
   3. Approved centering device between inner benchmark and outer casing as shown.
   4. Protective concrete access box with lock-type heavy duty cover as shown. Furnish two wrenches for cover.

B. Surface Settlement Points:
   1. Vertical masonry-concrete surface type: Three-piece expansion anchors, outer lead-alloy sleeve, inner lead-alloy wedge nut, and stainless steel cap head bolt.

C. Track Movement Points:
   1. As required by Amtrak Engineering, Track Monitoring.

PART 3 EXECUTION

3.01 INSTRUMENT INSTALLATION SCHEDULE

A. Install instrumentation prior to beginning dewatering operations, temporary earth retention structures, and micropile installation.
3.02 INSTRUMENT LOCATIONS

A. Establish and monitor surface settlement points and track movement points when any work that could potentially affect the stability of catenary poles or the track is occurring within 50 feet of a catenary pole or track, or within the influence line of a track. The influence line descends from a point one foot horizontally away from the outside end of the tie bottom, one unit vertically for every unit and a half horizontally.

B. Locate benchmarks outside of the area influenced by dewatering operations, excavations and micropile installation operations as required. Provide a minimum of one cased deep benchmark.

C. Obtain prior approval of the Engineer for monitoring point locations.

D. General locations of surface settlement points are on exterior surfaces of structures. Exact location of each surface settlement marker will be determined in the field.

E. Locate track movement points as required by Amtrak Engineering, Track Monitoring.

F. Paint instrument identification number on an adjacent surface. Use stencils cut for purpose. Do not free-land letter or spray-paint identification numbers. Where adjacent surfaces do not exist, erect or drive into ground a substantial wooden marker and paint identification number on marker.

G. After monitoring points have been installed, or if damaged and reinstalled, prepare working drawings and reports summarizing location and installation of each point.

1. Show the following on working drawings:
   a. Principal features of work and existing construction.
   b. Established elevation of each cased deep benchmark and initial elevation of each surface settlement point and track movement point.
   c. Instrument identification number and instrument type.

2. Show the following on working drawings or in report form:
   a. Date of installation.
b. As-built configuration of each point including elevations, station, and offset related to centerline of Track No. 1 and other dimensions of key elements of each monitoring point.

3.03 INSTALLATION OF CASED DEEP BENCHMARKS
A. Install cased deep benchmarks as shown.
B. Drive outer casing vertically to required elevation. Drill ahead of outer casing as required to penetrate dense soil strata.
C. Seat outer casing at two feet above tip elevation.
D. During assembly and lowering into outer casing, install centering devices between inner benchmark pipe and outer casing as shown.
E. Prepare and cut bottom one foot of inner pipe. Drive inner pipe until split ends have reached full depth, and are spread and gripped into sides of hole for positive anchorage; test and check for anchorage and pullout; if pipe can be pulled out, redrive until securely anchored.
F. Pump bentonite slurry into annular space between inner and outer pipe completely filling space. Cut pipes at correct height and install top centering device and disk.
G. Weld stainless steel ball read point to top end of benchmark pipe.
H. Install protective access box and cover over end of outer casing. Lock the box cover.

3.04 INSTALLATION OF SURFACE SETTLEMENT MARKERS
A. Install surface settlement markers as shown.
B. Masonry-Concrete Surface-Type:
   1. Drill correct diameter and depth hole into receiving surface.
   2. Blow out drilling debris from hole.
   3. Assemble expansion anchor and insert into hole.
   4. Tap outer sleeve onto wedge nut to affect initial sleeve contact with wall of hole.
   5. Expand outer sleeve into tight contact with wall of hole by turning until anchor is rigid within hole. Do not strip wedge nut threads by excessive turning of bolt.
3.05 SURVEY CONTROL

A. Establish cased deep benchmarks from SEPTA benchmarks to tolerance specified.

B. Establish elevation of cased deep benchmarks by running level circuits started and closed at specified SEPTA benchmarks.

1. Use three-wire leveling methods.
2. Establish turning points during leveling so that foresight and backsight distances are approximately equal.
3. Use turning points consisting of well-defined surface points of solid objects or masonry nails driven into pavement.
4. Do not exceed sight distances of 100 feet.
5. Achieve level circuit closures with error-of-closure less than 0.01 foot. If error-of-closure greater than 0.01 is achieved for any level circuit, resurvey circuit.
6. Adjust optical survey data for circuit closure error by dividing error by number of setups and distributing quotient equally among turning points.
7. Prove established elevations of cased deep benchmarks. Run at least three separate and complete level circuits which yield consistent results.
   a. Should an inconsistent elevation for any deep benchmark result, resurvey level circuits until correct and repeatable elevations are obtained.

C. Establish above points prior to start of excavation support and protection structure construction and dewatering.

D. Establish initial elevations of instrumentation from cased deep benchmarks. Determine elevation from multiple base reference readings.

E. Check elevation of cased deep benchmarks every month.

3.06 INSTRUMENT MONITORING

A. Initial Reading:

1. Obtain initial readings on each installed instrument or point location. Prove initial elevations.
2. Obtain at least three separate and complete sets of initial readings on each instrument which yield consistent results.

3. Should an inconsistent initial reading on any instrument result, reread instrument until correct and repeatable initial readings are obtained.

4. Initial readings should be confirmed 2 days prior to the start of work.

5. Initial readings immediately after any surfacing operations shall serve as new baseline figures. All future readings shall be compared to the adjusted baseline.

B. Movement Monitoring Along Tracks:

1. Obtain a dynamic load measurement at each movement monitoring point located within the tracks. The dynamic load measurement device will consist of a wooden stake placed firmly in the ballast and initially in contact with the bottom of the rail. The loaded measurement is the resultant gap between the bottom of the rail and the top of the stake caused by the deflection of the rail under the load of a passing train. Based on field observations of the excavation, and at the option of the SEPTA, this requirement may be reduced.

2. Elevation readings taken along the tracks for static measurement and the dynamic reading shall be combined and the sum compared to the adjusted baseline. This reading will demonstrate the difference in elevation caused by construction activities.

C. Survey Methods

1. Use survey methods for reading of instruments as specified for survey control.

2. Obtain initial and subsequent elevations of instruments by running level circuits started and closed at cased deep benchmarks.

D. Monitoring Frequency: Monitor instruments in accordance with the following:

1. Monitor each surface settlement point and track movement point at the beginning and end of every 8-hour shift when excavation support installation, micropile installation, or excavation is within 100 feet of point. During excavation within 100 feet of the point, check the top of rail elevations every hour.
2. Continue monitoring once per 8-hour shift for a minimum of 2 weeks after the completion of work (including backfilling) in the above specified areas. Otherwise, monitor all instruments and locations monthly.

3. Additional readings may be required by the Engineer.

E. Instrumentation Monitoring Threshold Values:

1. Implement contingency plans as specified in Article 1.03.F. above when instrumentation data indicates adverse settlement, movement, and/or loadings as specified below.

2. Instrumentation monitoring threshold values are the amounts of vertical and/or horizontal movements which, if exceeded, require the implementation of approved contingency plans as submitted in accordance with Article 1.03.F. above.

   a. Notify the Engineer immediately after obtaining any measurement that exceeds the Level 1 threshold value.

   b. Construction activities shall cease and tamping and realigning of tracks will be required whenever Level 1 threshold values for track movement are exceeded.

   c. Notify the Engineer immediately after obtaining any measurement that exceeds the Level 2 threshold value for that instrument. If Level 2 movements develop, construction activities shall cease. Submit to the Engineer the Contractor recommended contingency plan from the various plans submitted for stopping further movement and prevention of additional damage. An agreement shall be reached between the Engineer and the Contractor on the contingency plan to be utilized. Depending on the conditions, the Engineer may suspend construction activities. Subsequent to implementing the agreed upon actions, perform a detailed evaluation of construction procedures and submit to the Engineer the evaluation and recommended procedures to reduce movement. Obtain approval of the Engineer prior to restarting construction activities.

3. Level 1 threshold values:

   a. Surface settlement points: 0.5 inch

   b. Track movement points, vertical movement: Deviation from profile of 0.375 inches for 31-foot chord and 0.375 inches for 62-foot chord.
c. Track movement points, horizontal movement: Deviation from horizontal alignment of 0.188 inches for 31-foot or 62-foot chord.

d. Track movement points: Difference in cross level of 0.375 inches between any two points less than 10 feet apart and of 0.50 inches between any two points less than 62 feet apart.

4. Level 2 threshold values:

a. Surface settlement points: 1.0 inch.

b. Track movement points and track settlement sensors, vertical movement: Deviation from profile of 0.75 inches for 31-foot chord and 0.75 inches for 62-foot chord.

c. Track movement points, horizontal movement: Deviation from horizontal alignment of 0.375 inches for 31-foot or 62-foot chord.

d. Track movement points: Difference in cross level of 0.375 inches between any two points less than 10 feet apart and of 0.50 inches between any two points less than 62 feet apart.

3.07 INSTRUMENT PROTECTION, MAINTENANCE, AND REPLACEMENT

A. Provide approved substantial protective barriers as required around cased deep benchmarks.

B. Repair or replace damaged or missing monitoring points as required within five days at no additional cost to the SEPTA.

3.08 DISPOSITION OF INSTRUMENTS:

A. Fill, with Portland Cement mortar, holes drilled in masonry or concrete surfaces for surface settlement points.

B. Restore disturbed or damaged surfaces to conditions existing prior to installation of instruments.

C. Remove painted instrument identification numbers from building and other surfaces. Remove wooden markers and protective barriers.

D. Upon completion of Contract, leave cased deep benchmarks in place. Set cased deep benchmark protective covers flush with pavements or finished grade.

END OF SECTION
SECTION 02210

GRADING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Excavation, backfill and embankment necessary to grade site(s) to lines indicated on Drawings.

B. Related Sections:

1. Section 02050 – Demolition.
2. Section 02220 – Grading, Excavation, and Backfill.
3. Section 02270 – Erosion and Sedimentation Control.
4. Section 02910 – Topsoil.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T 99, Moisture-Density Relations of Soils, Using a 5.5 lb. Rammer and a 12 inch Drop.

B. ASTM International (ASTM):

2. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft.-lbf/ft.\(^3\)).
3. ASTM D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D2167, Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
C. Occupational Safety and Health Administration (OSHA).

1.03 DEFINITIONS

A. Rock Excavation: Consolidated hard mineral material mass exceeding 1/2 cubic yard in volume. Structure foundations of concrete or of masonry or stone laid in cement mortar is also classified as rock if volume requiring removal at a single location exceeds 1/2 cubic yard.

B. Earth Excavation: Materials in excavation that, in opinion of SEPTA Project Manager cannot be classified as rock excavation.

C. Unclassified Excavation: Material removal of any kind in excavation, including rock excavation.

D. Subgrade: Prepared earth surfaces where on or over additional materials are placed or work is performed.

1.04 SUBMITTALS

A. Backfill Material (including embankment and select materials): For each backfill material used, submit laboratory test results for moisture-density relationships, per ASTM D698, Method D.

B. Field Tests: Submit copies of each field density, liquidity, plasticity, and gradation test within 24 hours after completion of testing.

C. Permits for disposal of excavated material:
   1. Obtain written permits and releases from owners of property where material will be deposited.
   2. Submit copies of each permit to the SEPTA Project Manager to verify materials have been disposed of legally and in a proper facility.

D. Delivery Tickets: Submit a delivery ticket with each load of imported borrow material delivered to the site, stating the type of fill material and the quantity.

1.05 QUALITY ASSURANCE/QUALITY CONTROL

A. Test Reports: Submit for approval complete sieve analysis, compaction density, liquid limit and plastic limit test reports for on site, borrow excavated material, and delivered off-site material desired to be used for backfill and embankment fill. Test in accordance with specified Reference Standards. For disapproved material, either submit for approval above
data for new borrow material, or procedures and materials proposed to be
used to obtain approved stabilizations and densities for excavated
materials.

1.06 PROJECT CONDITIONS

A. Classification of Excavated Materials: No consideration will be given to
nature of materials encountered in site grading operations. Therefore, as
unclassified excavation, no additional payment will be made for difficulties
occurring in excavating and handling of materials.

B. Environmental Requirements:

1. Do not perform grading when soil or weather conditions are
unsuitable. Unsuitable conditions include moisture saturated or
frozen in place soil and precipitation present on soil or occurring
during Work.

2. Exercise necessary means and methods to control dust on site as
well as in off site work areas where excavation and grading are
required.

3. Do not leave site in a dusting condition following work of this Section.
   If necessary, employ a watering schedule to control dust.

4. Do not use frozen material in performing work or place materials on
   frozen surfaces.

5. When it is necessary to haul soft or wet soil material over roadways,
   use suitably tight vehicles to prevent spillage. Clear away spillage of
   materials on roadways caused by hauling at no expense to SEPTA.

6. Plan work so as to provide adequate protection during storms with
   provisions available constantly for preventing flood damage.

7. Slope trench excavations and embankments to prevent puddling.
   Control runoff in accordance with Section 02270.

C. Explosives and Blasting: Not permitted in performance of site grading
work.

D. Protection: Assume risks attending presence or proximity of overhead or
underground public utility and private lines, pipes, conduits and support
work, existing structures and property of whatever nature, in or over
excavations or adjacent to excavations. Assume complete responsibility
for replacement and restitution work of whatever nature to above, as
damaged or destroyed by work of this Contract, and at no expense to
SEPTA.
1. Outside Property Limits or Rights-of-Way: Take necessary precautions to protect trees, shrubs, lawns and other landscaping from damage. Restitution work for damages rests solely with Contractor and at no expense to SEPTA.

2. Temporary Protective Construction: Erect and maintain without expense to SEPTA, substantial barricades to exclude pedestrians or vehicles.

E. Borrow Excavation: Where required quantity of backfill exceeds quantity of suitable material excavated within limits of project site and Rights-of-Way, obtain sufficient material to complete backfill at no additional cost to SEPTA. If borrow excavation is needed, notify SEPTA Project Manager sufficiently in advance of borrow excavation requirements to permit SEPTA Project Manager to verify need for borrow excavation and to view proposed borrow pit. Borrow excavation from outside sources is subject to approval of SEPTA Project Manager. Obtain written consent before use of borrow excavation from outside sources.

F. Excess Materials: No right of property in materials is granted of excess on site materials prior to completion of Site Work. This provision does not relieve responsibility to remove and dispose of surplus excavated materials. Dispose of legally off site, unsuitable materials including sod, stumps, spongy soil, as well as excess rock.

G. Accommodation of Traffic: Do not obstruct streets, roads, and highways. Unless Municipality, Governing Agency, or SEPTA authorizes in writing complete closing of street, road, or highway, employ necessary measures at no expense to SEPTA to keep street, road, or highway open and safe for traffic.

H. Excavation Limits: Excavate to lines, grades, and slopes indicated on Drawings or to depths and dimensions required to produce a satisfactory foundation surface as determined by SEPTA Project Manager.

I. Slopes of Open-cut Excavation: Maintain stable slopes, and comply with OSHA requirements for slopes of open-cut excavation. Overexcavation without authorization by Project Manager will not be paid for, nor will payment be made for overexcavation and refill. Remove slides of material and repair at no additional cost.

1. Excavate slopes to angles necessary to ensure safe working conditions and stable slopes.

2. Excavate slopes to angles indicated on Drawings. If necessary to ensure safe working conditions and stable slopes, excavate slopes to flatter angles.
J. Scaling: Scaling of excavated rock and earthen surfaces is required throughout life of Contract. Scaling produces surfaces free from loose and dangerous rock. Utilize protective fencing at toes of slopes, mesh coverings on slopes, or other devices where recurring problems exist or where scaling alone is not sufficient.

PART 2 PRODUCTS

2.01 MATERIALS

A. Embankment and Backfill in Areas 5 Feet Beyond Structures (General Fill): Use on site or borrow excavated soil or soil rock material free of topsoil, plant life, lumber, metal, and refuse and meeting the following requirements for site grading backfill and embankment 5 feet beyond structures. Rocks contained in suitable material must pass through a 6 inch by 3 inch opening, and not exceed 10 percent of backfill or embankment volume. Provide soil with at least 60 percent passing #4 sieve when tested in accordance with ASTM D422; a liquid limit of not more than 45 and a plasticity index of not more than 25 when tested in accordance with ASTM D4318; and a maximum dry density of not less than 100 pounds per cubic foot.

1. Construction requirements for roadway embankment containing rock are as specified in Section 02220.

B. Backfill and Embankment in Areas Below or Within 5 Feet of Structures (Select Compacted Fill): On site or borrow excavated soil meeting above requirements for General Fill and embankment areas 5 feet beyond structures, except size of rock not to exceed 3 inches in largest dimension.

PART 3 EXECUTION

3.01 PREPARATION

A. Salvaged Topsoil: Within areas indicated for grading, strip topsoil to depth of suitable topsoil material and stockpile for subsequent topsoiling operations. See Section 02220.

1. Topsoiling: Perform as work of Topsoil as specified in Section 02910.

3.02 PERFORMANCE

A. Erosion Control: Implement erosion control measures prior to and during performance of work of this Section. Erosion Control as specified in Section 02270.

B. Vehicle Traffic Area Grading: As specified in Section 02220.
C. Excavation of Borrow Material: Perform excavation of borrow material in a manner satisfactory to SEPTA Project Manager. Strip borrow pits of brush, trees, roots, grass and other vegetation prior to removal of material for use in backfill. During excavation operation, grade borrow area to ensure free drainage of water from area. Place and maintain erosion control devices after completion of excavation, grade excavated area including side slopes to drain and present a uniformly trim appearance merging into surrounding terrain. After borrowing operations are completed, regrade area, if necessary, to prevent erosion.

D. Removing Obstructions: Where rock is encountered at proposed subgrade elevations and topsoil is required, remove rock for a depth of twelve inches below proposed subgrade.

E. Preparation of Subgrade for Embankments: Perform sufficient in place density tests on supporting material to show that material is in stable condition with proper density. Compact supporting material if necessary.

F. Placement and Compaction of General Fill: Construct embankments, except embankments for roadways and around new structures, in accordance with the following paragraphs.

1. Place fill in lifts no thicker than one foot and compact using approved equipment. Carry whole embankment up evenly to required elevation without breaks or irregularities in material distribution or in formation of layers. Trim embankment slopes to lines indicated on Drawings and leave in a neat and acceptable condition.

2. Add water to fill not containing sufficient moisture to obtain required compaction. Harrow, or use other approved methods, to work moisture into material until a uniform distribution of moisture is obtained. Fill containing moisture in excess of moisture required to obtain necessary compaction density may not, without written approval, be incorporated in embankment until allowed to dry to a moisture content not greater than two percentage points above optimum for that particular material. Do not place frozen material, ice, or snow in embankments.

3. Fill existing natural or other depressions resulting from site work to level of adjacent ground elevation in manner specified for formation of embankment prior to starting initial embankment layer. Provide material for this operation of type used adjacent to structures.

4. Remove existing embankment foundation material when determined unsatisfactory by SEPTA Project Manager. Backfill areas to original elevation with general fill, placed and compacted as specified herein.
5. Scarify embankment foundation surface where embankment of three feet or more in height is placed. If compacted surface of any layer of material is determined to be too smooth to bond properly with succeeding layer, loosen surface by harrowing or by other method approved by SEPTA Project Manager before placing succeeding layer.

6. Plow existing embankment foundations having a slope steeper than four to one to provide embankment binding when required by SEPTA Project Manager. On steeper slopes SEPTA Project Manager may require foundation be cut into steps or berms.

7. Compact each lift with at least 5 passes of compaction equipment suitable for material being placed and suitable for requirements of fill. Suitability of equipment for fills to be determined by SEPTA project Manager based on field performance of equipment. Furnish alternate compaction equipment if SEPTA Project Manager deems equipment being utilized is ineffective or inappropriate for conditions and requirements of fill being placed.

8. During dumping and spreading process, maintain a constant force of workers, adequate to remove and dispose of stones with dimensions greater than 3 inches by 6 inches, roots and debris from embankment materials.

9. During construction, keep top of partially completed embankments shaped and drained continuously.

G. Placement and Compaction of Select Compacted Fill: As specified in Section 02220.

H. Topsoil: As specified in Section 02910, Topsoil.

3.03 FIELD QUALITY CONTROL

A. Field Moisture-Density Tests: When deemed necessary by SEPTA Project Manager, conduct a minimum of two field moisture-density determinations per 500 square feet placed in a horizontal layer at locations designated by SEPTA Project Manager. Field dry density to equal or exceed 95 percent of maximum dry density, and in place moisture content to be within percentage points of optimum moisture contents, as determined per ASTM D698.

1. Moisture content at which maximum density of backfill is obtained with a given compactive effort, AASHTO T 99, is considered optimum moisture content.
2. Field compaction density may be determined by Sand Cone Method ASTM D1556, Rubber Balloon Method ASTM D2167, Nuclear Method ASTM D2922, or other acceptable method as approved by SEPTA Project Manager.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Placement and supplemental additions to topsoil as required to restore disturbed areas.

1.02 REFERENCES

A. ASTM International (ASTM):


1.03 SUBMITTALS

A. Test Reports: Submit laboratory test reports of soil analysis and supplement recommendations to SEPTA Project Manager for approval prior to adding any soil supplements to topsoil.

1. Laboratory reports to recommend both grade and application rates of fertilizer, and such other soil supplements as required.

2. Take sufficient quantity of topsoil samples to give a representative analysis of on-site topsoil and topsoil from outside sources, if any.

B. Soil Supplement Product Certification: Submit certificates certifying such products to have a guaranteed analysis in conformity with SEPTA Project Manager approved laboratory soil supplement recommendations report.

C. Chain-of-Custody Forms: Submit Chain-of-Custody tracking forms and documentation.

1.04 QUALITY ASSURANCE

A. Quality Control:

1. Packaged Products to indicate manufacturer's guaranteed analysis on each package and arrive on site as originally packaged and unopened.

2. Contractor to submit product delivery slips to SEPTA Project Manager.
1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged products to site in unopened containers with labels intact and legible.

B. Store packaged products in a manner to prevent moisture damage and other forms of contamination.

1.06 PROJECT CONDITIONS

A. Environmental Requirements: Do not perform work of this Section when soil or weather conditions are unsuitable. Unsuitable conditions include moisture saturated or frozen in place soil and precipitation of any kind present or occurring during work.

B. Existing Conditions: Following performance of related construction, and prior to finish grading, perform debris removal and site leveling as necessary in preparation for finish grading. Dispose of debris legally off site.

C. Dust Control: Exercise necessary means and methods to control dust on site as well as in off site work areas where topsoiling and finish grading are required.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: Use fertile, friable, natural, productive surface soil as is available on site (if any). Use topsoil free of subsoil, clay, stones, or similar hard objects larger than 1 inch in greatest dimension and partially disintegrated debris and materials toxic or harmful to growth. Acceptable topsoil to contain organic matter in range of 1.5 percent to 20 percent.

B. Borrow Topsoil: Use productive topsoils from Contractor's source and of a quality meeting requirements specified above for Topsoil. Furnish any additional topsoil necessary to complete work at no additional expense to SEPTA. Submit chain-of-custody tracking forms and documentation to SEPTA.

2.02 SOIL SUPPLEMENT MATERIALS

A. Agricultural Liming Materials: Products containing calcium and magnesium compounds capable of neutralizing soil acidity and containing not less than 80 percent of total carbonates. Use liming materials meeting requirements of ASTM C602 and conforming to applicable state liming material regulations.
B. Fertilizer: Commercial fertilizer of uniform composition, free-flowing and in
conformity with applicable state fertilizer laws.

1. Analysis: As recommended by laboratory soil supplement
recommendations report.

PART 3 EXECUTION

3.01 PREPARATION

A. Prepare subsoil surface for finish grading by dressing and shaping to
provide for uniform placement of topsoil.

B. Prepare subsoil surface for topsoiling by loosening to a depth of 6 inches
and dressing and shaping to provide for uniform placement of topsoil.

C. Remove surface rock or other foreign objects exceeding 3 inches in
greatest dimension. Dispose of rock and debris off site in a lawful
manner.

3.02 PERFORMANCE

A. Placement: Place topsoil over areas indicated for new grading contours.
Ensure construction work in topsoiled areas is completed before topsoil
placement. Observe precautions as follows:

1. Do not place topsoil over areas indicated to receive paving or
walkways.

2. Do not work topsoil while frozen or wet. Do not work topsoil into a
dusting condition. Moisten topsoil to prevent a dust nuisance.

3. Scarify subsoil to a depth of 6 inches for bonding topsoil with subsoil.

4. On sloped areas, work topsoil into subsoil to blend so as to eliminate
any semblance of slip-planing between two soils; but leave a
sufficient cover of topsoil to ensure seed germination. Perform
blending of soils by ridging or serrating subsoil on slopes.

5. Place topsoil as needed for dressing-up minor depressions due to
settling and erosion and to eliminate any other minor irregularities.

B. Finished Elevations and Lines: Grade topsoiled areas of site to within a
tolerance of plus or minus 1/10 of a foot of elevations and lines indicated
and in accordance with following:
1. Grade a uniform longitudinal fall in swales and other surface drainage areas to provide a drainage flow line that can easily be maintained and traversed with normal lawn maintenance equipment.

2. Establish finish grade of topsoil 1/2 to 3/4 inch below top of abutting walks or paving to provide positive drainage.

3. Do not finish grade topsoil to a depth less than 6 inches nor greater than 12 inches.

4. Leave finish grade surfaces free of objectionable material larger than one inch in greatest dimension. Dispose of objectionable material in a legal disposal area off site.

C. Compaction: Compact finish grades as final operation using a light roller weighing not over 120 pounds per foot width of roller.

D. Tillage: Till finish graded soil over areas indicated for lawn regardless of type of lawn work performed. Use equipment and methods common to such work, and till soil to a 3 inch depth minimum.

E. Soil Supplement Addition: Soil supplements for lawn areas, as required according to SEPTA Project Manager approved laboratory test reports, may be incorporated into soil during tillage operations.

END OF SECTION
SECTION 02220
GRADING, EXCAVATION, AND BACKFILL

PART 1 GENERAL

1.01 SUMMARY

A. The work specified in this section consists of construction of excavating and backfilling for paved areas and structures; field quality control testing and analysis.

B. Related Work Specified Elsewhere:
   1. Section 01300 – Submittals.
   2. Section 02160 – Excavation Support and Protection.

C. Definitions:
   1. Approved material: Material that meets specified requirements for use as embankment, fill, or backfill.
   2. Authorized excavation: Excavating to neat lines and limits shown and specified; excavating unsuitable material.
   3. Backfill is the furnishing, placing, and compacting specified materials to the lines and grades indicated, to fill an excavation, and also including:
      a. Testing density, liquid and plastic limits, and gradation of compacted backfill.
   4. Excavation is the removal of all materials encountered within the indicated or specified limits, and to subgrade elevations, regardless of the nature of the material encountered and the method by which removed and also including:
      a. Dewatering.
      b. Legally disposing of waste materials and storing satisfactory excavated materials intended for reuse.
   5. Excess excavation: Material excavated beyond or below cross section shown, as well as unavoidable over breakage in rock.
6. Unauthorized excavation: Excavating materials which would otherwise be left in place but removal of which is required because the Contractor’s operations have rendered them unstable; excavation which is not specified as authorized excavation, such as excavation beyond neat lines and bottom of footings and trenches as shown. Excavation below subgrade elevations or beyond indicated dimensions without direction by the SEPTA Project Manager. Unauthorized excavation as well as remedial work directed by the SEPTA Project Manager shall be without additional compensation.

7. Bedding material: Layer placed over the excavated subgrade in a trench before laying pipe.

8. Base course: Layer placed between the subgrade and paving.

9. Unsuitable material: Material which does not meet specified requirements of satisfactory soil material for use in situ or as fill or backfill and is prohibited for use in the work.

1.02 QUALITY ASSURANCE

A. Reference standards:

1. ASTM International (ASTM):


   b. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft$^3$ (600 kN-m/m$^3$)).

   c. ASTM D1556, Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

   d. ASTM D2167, Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

   e. ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).


   g. ASTM D4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
h. ASTM D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).


2. American Association of Highway and Transportation Officials (AASHTO):
   a. M43, Sizes of Aggregate for Road and Bridge Construction.
   b. M147, Materials for Aggregate and Soil-Aggregate Sub base, Base and Surface Courses.
   c. M80, Coarse Aggregate for Portland Cement Concrete.

3. Commonwealth of Pennsylvania, Department of Transportation (PENNDOT):

B. Testing Agency: The Contractor shall contract an agency meeting or exceeding the evaluation criteria of ASTM D3740. The laboratory and field testing shall be performed under the general supervision of a Registered Professional Engineer. The independent testing agency shall have experience in quality control of earthwork operations.

C. Laboratory Tests: As a condition of the Contract Documents, the Contractor shall provide advance examination for testing of the specified materials according to methods referenced or as required by the SEPTA Project Manager.

   1. Arrange for the testing laboratory to furnish both SEPTA Project Manager and Contractor two copies of test result reports. The same reports will be considered as sufficient evidence to serve as a basis for acceptance or rejection of materials presented.

1.03 SUBMITTALS

A. In accordance with Section 01300, submit the following for approval:

   1. Certificates of compliance of materials for liquid limit, plasticity, and dry density. (Note: SEPTA Project Manager reserves the right to test materials for specification compliance).
2. Field Tests: Submit three copies of each field density, liquidity, plasticity, and gradation test within 24 hours after completion of testing.

3. Permits for disposal of excavated material shall meet requirements of Specification 02400:

4. Submit laboratory test data defining materials meet the criteria listed in this Specification.

5. Furnish and deliver samples of fill and backfill materials as selected by the SEPTA Project Manager for verification and certification for submission to testing laboratory.

6. Submit a delivery ticket with each load of imported borrow material delivered to the site stating type of material and the quantity.

1.04 JOB CONDITIONS

A. Barricade open excavations and post with warning lights those excavations occurring on property adjacent to or within public access. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

B. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by excavation and backfill operations.

C. Existing underground facilities: Indicated locations of known existing facilities and systems are approximate. Investigate and determine exact locations and natures of facilities and systems, and accept sole responsibility for damages thereto caused by construction activities. Before excavating in the vicinity of underground utilities, notify the appropriate jurisdiction or utility as specified in Section 01060. SEPTA does not guarantee that all facilities and systems, which may exist before the work begins, are indicated. Comply with PA Act 287 and all amendments (PA One-Call system).

1. Preserve, protect, and maintain existing operable drains and sewers.

D. Keep excavations dry.

E. Use of explosives is prohibited.

F. Toxic and Combustible Substances:

1. During excavation, provide equipment and carry out such tests as necessary to detect presence of toxic and combustible substances.
2. If the presence of noxious or explosive gas is indicated, immediately discontinue excavation operations and notify the SEPTA Project Manager. Do not resume work at said locations until the necessary safety measures have been taken and further tests indicate the absence of any noxious or explosive gases.

3. Take action to safeguard persons and property in accordance with rules and regulations of jurisdictional agencies and utility owners.

4. Promptly notify utility owners when problems concerning their facilities become apparent.

PART 2 PRODUCTS

2.01 FILL OR BACKFILL

A. Common Fill:

1. Composition:
   a. Well graded soil-aggregate mixture comprising stone, gravel, sand, silt, clay, or combinations of such materials.
   b. Prohibited material: Organic matter, construction debris, wood, cinders, and frozen material, deleterious material, or obviously contaminated soil.

2. Additional Requirements:
   a. Particle size: Three inches maximum, but not exceeding one inch within one foot of finished grade.
   b. Liquid limit: Forty maximum, determined in accordance with ASTM D4318.
   c. Plasticity index: Ten maximum, determined in accordance with ASTM D4318.
   d. Maximum dry density: Not less than 100 pounds per cubic foot.

B. Select Backfill Material:

1. ASTM D2487 soil classification groups GW, GP, GM, SW, SP, and SM or in combination of these group symbols; free of rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material shall be free of organic matter and deleterious materials including wood, roots, and construction debris.
2. AASHTO M43, Size No. 57.

C. Aggregate Backfill: AASHTO No. 57 coarse aggregate meeting the requirements of PENNDOT Publication 408.

D. Structural Fill Materials:
   1. Class C Cement Concrete conforming to the requirements of Specification 03300.
   2. Structural Aggregate Backfill: PENNDOT 2A Coarse Aggregate per Publication 408 Section 703 (Aggregates).
      a. Laboratory Dry Density: 100 pcf minimum
      b. Dry Change (ASTM D427): 12 percent maximum
      c. Gradation per PENNDOT Publication 408.

2.02 CRUSHED AGGREGATE FOR PAVEMENT

A. No. 2A, Coarse Aggregate; PENNDOT Specifications Publication 408, Section 703, latest edition and all supplements.

2.03 TRENCH BEDDING AND BACKFILL

A. Bedding Material:
   1. AASHTO M43, Size No.57.

B. Backfill Material:
   1. Select backfill material as specified in Article 2.01.

2.04 TUNNEL FILL MATERIAL

A. Flowable Fill:
   1. Type C Mix meeting requirements defined in PENNDOT Publication 408.
   2. Provide results of slump tests and 28-day compressive strength test.

2.05 SOURCE OF MATERIALS

A. To the extent that it is available, obtain material from excavation operations. If sufficient satisfactory materials are not available to meet fill and backfill requirements, obtain material meeting specified requirements
for satisfactory soil material from outside sources at no additional cost to SEPTA.

1. Earth excavation may contain excess moisture in its natural state or may take on excess moisture during handling and stockpiling. Manipulation to dry material to proper moisture content prior to compaction may be necessary. Earth excavation will not be considered as unacceptable backfill material by virtue of its moisture content only.

B. Use only material whose quality, source, and zone of placement in the fill have been approved.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. The Contractor is responsible for setting and establishing finish elevations and lines.

B. Disposal of Surplus and Unsuitable Material: Haul from site and legally dispose of any excavated materials which are excess or are determined to be not suitable for filling or backfilling, at no additional cost as defined in Specification 02400.

C. Unfavorable Weather: Do not place, spread, roll, or compact fill material that is frozen or thawing, or during unfavorable weather conditions. If interrupted by heavy rain or other unfavorable conditions, do not resume until ascertaining that the moisture content and density of the previously placed soil are as specified.

D. Maintenance of Excavation:

1. Excavate and remove material outside the limits of excavation which, in the opinion of the SEPTA Project Manager, is unstable and constitutes potential slides, and material which comes into excavations for any reason.

3.02 ROUGH GRADING AND FILLING

A. Perform such soil, concrete, and rock fragment removal or fill as may be required to facilitate the progress of the work.

B. Fill holes that will not be completely removed by excavation, with structural fill material approved by the SEPTA Project Manager and compacted as specified herein, in layers not exceeding six inches after compaction.
C. Fill low points that will not otherwise be removed in the course of the work, to the indicated grades.

3.03 PUMPING AND DRAINAGE

A. At all times during construction of the work and at its completion for final inspection by the SEPTA Project Manager, provide and maintain ample means and suitable equipment, consistent with conditions encountered, to promptly remove and properly dispose of all water entering excavations or other parts of the work.

B. Control surface and subsurface water in excavations at all times until the structures to be built therein are completed and backfilled to approximately final grades.

C. Dispose of water in a suitable manner approved by the SEPTA Project Manager so as to avoid damage to adjacent property, existing structures and all work under construction. Do not pump drainage water onto the streets.

D. Install oil/water separator in the event floating petroleum product is encountered. SEPTA has been remediating the site of a localized heating oil product floating plume associated with former station underground storage tank as described in the Subsurface Investigation Section 02010.

E. Provide and maintain, settling basins and sumps for catching and holding settleable matter. These shall be frequently cleaned and maintained. Wherever water-containing mud, clay, sand or other material in suspension, is pumped from the excavations, make suitable provision to insure that the flow will be unobstructed. Take precautions to avoid pumping water through freshly placed concrete.

F. At no time shall the uplift pressure on any structure exceed 80 percent of the downward pressure produced by the weight of the structure and any backfill in place. The Contractor shall submit his proposed methods of controlling uplift pressure to the SEPTA Project Manager for approval prior to the start of excavation.

3.04 EXCAVATION

A. General Requirements:

1. Excavate to the lines and grades indicated.

2. Support sides of excavation in accordance with applicable OSHA regulations and Section 02160 requirements.

3. Protect, support, and maintain utility facilities.
4. Proceed with caution in areas of utility facilities; expose them by hand excavation or other methods where required.

5. Remove excavated materials to fill, stockpile or disposal locations. Keep haul routes clean.
   a. Excavated material not required for use as fill or backfill will become the property of the Contractor and shall be disposed of off the job-site.

6. Fill unauthorized and excess excavations with approved materials as directed by the SEPTA Project Manager.

7. Excavation for the convenience of the Contractor shall conform to the limits specified by the SEPTA Project Manager at no additional cost to SEPTA.

8. Excavate for structures to the limits indicated on the Contract Drawings. If limits are not indicated, excavate to the limits required to construct the structure while maintaining support for all existing construction scheduled to remain in place, and all new construction in place prior to beginning structure excavation.

9. If unsuitable materials are encountered at the required subgrades, the SEPTA Project Manager may authorize the removal of such unsuitable materials and replacement with structural fill materials specified in Article 2.01 or with concrete.

B. Trench Excavation:

1. Excavate trenches for utilities and drainage pipes by the open cut method.

2. Excavate to required widths as shown or detailed.

3. In paved areas, cut pavement on the neat lines at the width indicated for the trench. After compacting the backfill, restore pavement structure to a condition equivalent to or better than that of existing adjacent pavement. Restore pavement damaged outside the neat lines at no additional cost.

3.05 FILL AND BACKFILL PLACEMENT

A. Place initial layer of fill and backfill only on subgrade, which has been inspected and accepted by the SEPTA Project Manager.

1. Do not place backfill material on wet or frozen material.
B. Place fill and backfill in eight-inch loose layers, unless otherwise shown, for entire width so that each layer can be uniformly and properly compacted. Compact each layer to the specified density for the entire width of the fill.

C. Avoid accumulation of large pieces of material at one location. Fill voids and interstices with finer materials.

D. In confined areas, use approved power-activated compactors to achieve required density.

E. Prior to compaction, adjust moisture content of material within required limits by drying or watering either at material source or on fill.

F. Design support system as required for adjacent facilities and structures in accordance with Section 02160.

G. Under concrete floor and other slabs on grade, place select material directly on prepared subgrade, which meets density and elevation requirements.

H. Maintain fill and backfill in stable, well-drained condition.

I. Remove material that cannot be compacted to required density within specified tolerances, and replace with suitable material at no additional cost.

J. Trench Backfill:

1. Except as may be otherwise specified for placement of bedding materials, place backfill around pipes as follows:
   a. Place backfill around bottom half of pipe, in layers not thicker than four inches, and in a manner that will ensure that pipe will be supported. Ram and tamp backfill placed under and around pipes with tools and equipment especially designed for that purpose.
   b. Deposit additional backfill to a point 12 inches above top of pipe but leave pipe joints exposed; compact backfill.

2. After pipe has been tested and accepted, place backfill as specified.

K. Allowable Tolerances:

1. Construct finished subgrade to vary not more than 0.05 foot above or 0.10 foot below elevation shown.
2. Maintain moisture content of fill or backfill material within plus or minus two percent of optimum moisture content of material.

3. Compact each layer of fill or backfill material to 95 or 98 percent (as noted on the drawings) of maximum standard dry density as determined in accordance with ASTM D698, Method D, at moisture content within tolerance specified, except as follows:
   a. Within the limits of 1:1 slopes spreading outwards in all directions from the bottom edge of structure footings, compact to 100 percent of maximum dry density at moisture content within tolerance specified.
   b. Within 24-inch depth below the bottom of slab-on-grade, compact each layer of filler backfill material to 100 percent of maximum dry density at moisture content within tolerance specified.
   c. From upper surface of fill or backfill to a plane 18 inches below bottom of sub base level of sidewalks, compact to 100 percent of maximum dry density at moisture content within tolerance specified.
   d. In areas of 95 percent compaction where utility facilities are located in fill and are not supported on concrete cradles, compact material for a depth of one foot directly below bottom of facility to 100 percent of maximum dry density at moisture within tolerance specified.

3.06 COMPACTION ADJACENT TO STRUCTURES

A. Compact fill or backfill materials within five feet of structures using plate compactors, power rammers, small rollers 5100 pounds max., etc.

B. Do not overstress structures.

C. Backfilling against new structures without approval is prohibited.

3.07 FLOWABLE FILL PLACEMENT

A. Place material at locations indicated on the Drawings and as directed by the SEPTA Project Drawings.

B. Place material in lifts not exceeding criteria listed in PENNDOT Publication 408.
C. Protect utilities that are to remain within the fill area from movement or damage. Replace or repair any damaged items as directed by SEPTA Project Manager at no additional cost to SEPTA.

D. During placement of fill material, take measures necessary to contain flowable fill within the limits to be filled.

### 3.08 SUBGRADE PREPARATION

A. Where the subgrade is on original ground or in cut or where fill is less than one foot, fulfill compaction requirement for 12 inches minimum below final subgrade.

B. Remove rigid pavements and slabs that would be within five feet of finished grade and subgrade. Rigid pavements and slabs, which will be five feet and more below, finished grade and subgrade may be left in-place only if broken into pieces not larger than three feet in greatest dimension.

C. For subgrade on which structures will be placed:
   1. If structures are indicated to be founded on rock and that rock has been undercut to an elevation lower than that indicated, fill undercut space with concrete of same class as that used in structure.
   
   2. If subgrade material is disturbed, either compact subgrade to 100 percent of maximum dry density when tested in accordance with ASTM D698; or remove and replace material with structural aggregate backfill material and compact to 100 percent of maximum dry density, tested in accordance with ASTM D698.

D. For subgrade on which pipe and/or conduit will be placed:
   1. Adjust trench bottom to line and grade by either scraping away soil or placing bedding material as specified.
   
   2. Smooth bottom of trench; remove rock and unsuitable material, which would be within one foot of pipe and conduit. Fill undercut space with bedding material and compact to bottom of pipe and conduit elevation.

E. For subgrade on which slab-on-grade or pavement will be placed:
   1. Proofroll subgrade using a portable, vibrating, walk-behind drum roller.
   
   2. When proof rolling indicates an area to be unstable or non-uniform, stabilize the area by performing additional compaction on these
areas, or remove the unsuitable material and replace it with structural fill materials.

3.09 FIELD QUALITY CONTROL

A. Test Method:

1. Determine the maximum dry density and the optimum moisture content in accordance with ASTM D698, Method D.

B. Testing:

1. Provide an independent testing agency qualified according to ASTM E329.

2. Test each source of material proposed to be used for fill and backfill and submit test results to the SEPTA Project Manager. Test material for moisture-density relationship in accordance with ASTM D698; for gradation in accordance with ASTM D422; for liquid limit in accordance with ASTM D4318; for plastic limit in accordance with ASTM D4318.

3. Fills:

a. Perform one in-place compaction test for each 5,000 square feet of material placed in each horizontal layer in accordance with either of the following: ASTM D1556, ASTM D2167, ASTM D6938. Except perform not less than one test for each layer.

b. Perform one maximum dry density test for every different fill material but not less than one test for every ten compaction tests.

4. Backfill at structures:

a. Perform one in-place compaction test for every 1000 square feet and every two feet of added height but not less than three compaction tests in any day during which material is placed. Perform compaction test in accordance with either of the following: ASTM D1556, ASTM D2167, ASTM D6938, and ASTM D2937, as applicable.

5. Trench Backfill:

a. Perform in-place compaction test every 25 linear feet for every two feet of added height, but not less than three tests in any day during which material is placed. Perform compaction tests
in accordance with either of the following: ASTM D1556, ASTM D2167, ASTM D6938, and ASTM D2937, as applicable.

3.10 DISPOSAL OF EXCESS WASTE AND WASTE MATERIALS

A. Remove all waste materials and excess materials including excavated material classified as unsatisfactory soil material, trash, and debris from SEPTA’s property and legally dispose of it. All excess soils must be transported off-site only to facilities approved by SEPTA.

B. Transportation shall be provided in accordance with Department of Transportation (DOT), state, and local requirements.

C. The Contractor shall submit proof of qualifications that its proposed waste transportation contractor is licensed and permitted through which they will travel with decals/placards appropriate for the excess soils removed from the project. The Contractor shall submit documentation of DOT training requirements, a list of vehicles and DOT-approved containers which will be available for use on the project, DOT violation history, and a list of other projects similar in magnitude to this project with contact names and telephone numbers.

D. The Contractor shall minimize storage of excess soils on SEPTA property by transporting excavated soils directly to the approved disposal facility when schedule and conditions prove practical.

E. The Contractor is responsible for obtaining fully executed manifest and certificates of disposal from the approved facilities. The documentation must be maintained by the Contractor for the duration of the project, with copies supplied to SEPTA. The Contractor shall maintain a log of all manifests with corresponding truck numbers and waste weights onsite at all times from SEPTA inspection.

F. The Contractor is responsible for controlling any possible tracking or spilling of materials on public roadways and shall perform all cleanup if such occurs at no additional cost to SEPTA.

G. All fill material being removed offsite must be disposed of at a SEPTA-approved facility and be handled in accordance with the PA DEP Management of Fill Policy. **No fill material may be disposed of in a quarry, at a commercial site, or at a residential site.** Disposal sites recommended by SEPTA include the Bellmawr Waterfront Development Site. The Contractor may submit an alternative proposed waste disposal facility meeting the requirements of these Specifications. Disposal shall not occur until written approval is provided by SEPTA.

H. The site soils may need to be tested to determine their suitability if they are to be disposed of at the Bellmawr Waterfront Development site located
in Bellmawr, New Jersey. The Contractor is responsible for any and all waste characterization required. This characterization shall be performed under the supervision of a licensed Professional Engineer in the Commonwealth of Pennsylvania.

I. If the Contractor selects a site outside of Bellmawr, all costs associated with soil characterization and disposal shall remain the responsibility of the Contractor, and no allowance will be made for an extension to the Contract completion date. Additionally, the entry requirements to any proposed alternative site must meet or exceed the entry requirements of that alternative site and the more restrictive requirements of Bellmawr or SECCRA.

J. The Contractor is required to properly dispose of all excess material in accordance with all environmental, federal, state, and local regulations. The Contractor shall provide SEPTA copies of all manifests, bills of lading, or certificates of recycling to substantiate the proper handling of material. The Contractor shall submit copies of current permits for the facilities. The Contractor shall submit proof of qualifications that its proposed facilities are presently licensed and permitted. The Contractor shall also submit a copy of the most recent inspection report from the disposer state, a history of violations/orders/deficiencies and their resolution, financial assurance documents, and a list of major customers with contact names and telephone numbers. Additionally, the Contractor shall submit to SEPTA any soil sample analysis that was conducted to characterize the soil for disposal purposes.

K. The Contractor shall maintain and provide SEPTA with all records for all soils and liquids taken offsite.

L. Handling, storage, transportation, and disposal of excess materials shall meet Specification 02400.

END OF SECTION
SECTION 02222

EXCAVATION, BACKFILL, AND COMPACTION FOR UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Excavating, placing bedding, backfilling, and compacting trenches for pipelines and utility structures specified or indicated on Drawings.

B. Related Sections:
   1. Section 02050 - Demolition.
   2. Section 02220 - Grading, Excavation, and Backfill.
   3. Section 02270 - Erosion and Sedimentation Control.
   4. Section 02501 - Superpave Asphalt Mix HMA Paving and Surfacing.
   5. Section 03300 - Cast-In-Place Concrete.

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft.-lbf/ft.3).
   2. ASTM D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

B. Commonwealth of Pennsylvania Department of Transportation (PENNDOT), Specifications Publication 408, as supplemented.
   1. PENNDOT Section 703.1, Fine Aggregate
   2. PENNDOT Section 703.2, Coarse Aggregates.
   3. PENNDOT Section 703.3, Select Granular Material (2RC).

1.03 DEFINITIONS

A. Earth Excavation: Removal down to subgrade elevation of clay, silt, loam, sand, gravel, slate, hard pan, pavements, soft sandstone, loose stone in masses, and boulders measuring less than 1/2 cubic yard.
1. Earth Excavation is Unclassified.

B. Rock Excavation: Removal down to subgrade elevation of large rock and boulders measuring more than 1/2 cubic yard or drilling and wedging in opinion of SEPTA Project Manager.
   1. Rock excavation is unclassified.


D. Subgrade: Trench bottom prepared as specified to receive Bedding, Concrete Cradle or Concrete Encasement, or excavation bottom prepared to receive pipeline structures.

1.04 SUBMITTALS

A. Test Reports:
   1. Submit testing laboratory aggregate test reports based on requirements stated in Quality Control.

   2. Compaction density test reports based on method of density determination as specified in Reference Standards and method approved by SEPTA Project Manager.

B. Certificates: Submit certificate from aggregate supplier based on requirements stated in Quality Control, when requested by SEPTA Project Manager.

C. Product Data: Submit catalog cuts and such other data required to provide information for the following:
   1. Geotextiles.
   2. Warning Tape.

D. Calibration of Equipment: Submit a list of equipment; calibration procedure and frequency calibrated.

1.05 QUALITY ASSURANCE

A. Quality Control:
   1. Laboratory Tests: Aggregate materials under Part 2 - Products require advance examination or testing according to methods referenced, or as required by SEPTA Project Manager.
a. Arrange for testing laboratory to furnish SEPTA Project Manager test result reports in triplicate. Test reports are considered sufficient evidence of acceptance or rejection of materials represented.

b. Conduct aggregate quality tests in accordance with requirements of appropriate Referenced Standard.

c. SEPTA Project Manager reserves right to accept aggregate materials based on certification from supplier that aggregate originates from a source approved by PENNDOT and that aggregate complies with specified PENNDOT requirements.

1.06 PROJECT CONDITIONS AND EXECUTION

A. General Requirements: Excavate and backfill trenches necessary for completing work of this Contract. Excavate and backfill trenches by machinery or by hand; SEPTA Project Manager is empowered, if necessary in his opinion, to direct that hand excavation and backfilling be employed. Excavate whatever substances encountered, to grades and depths indicated on Drawings, as specified, or as directed by SEPTA Project Manager. Remove and waste excavated material not required for backfill.

B. Environmental Requirements:

1. Do not perform trenching, backfilling, or compacting when weather conditions or condition of materials will prevent satisfactory work, in opinion of SEPTA Project Manager.

2. Do not use frozen materials as backfill or wet materials containing moisture in excess of quantity necessary for satisfactory compaction.

3. Prior to use, moisten dry backfill material not having sufficient moisture to obtain satisfactory placement or compaction.

4. Plan work to provide adequate protection during storms with provisions available constantly for preventing flood damage. Protect installed piping and other work against damage from uplift due to high ground water levels.

5. Accommodation of Drainage: Keep gutters, sewers, drains, and ditches open constantly for surface drainage. No damming, ponding, water in gutters, or other waterways permitted, except where stream crossings are necessary and then only to extent SEPTA Project Manager considers necessary. Do not direct water flows across or over pavements except through approved pipes or properly constructed troughs. When required, provide pipes or troughs of
sizes and lengths required at no expense to SEPTA. Perform grading in vicinity of trenches so that ground surface is properly pitched to prevent water running into trenches.

6. Pumping: Keep excavations free from water during performance of work at no expense to SEPTA. Build dams and other devices necessary for this purpose, and provide and operate pumps of sufficient capacity for dewatering excavations. Provide for disposal of water removed from excavations in a manner not to cause injury to public health, public or private property, work of others, portions of work completed or in progress, or produce an impediment to street, road and highway usage.

7. When necessary to haul soft or wet soil material over roadways, use suitably tight vehicles to prevent spillage. Clear away spillage of materials on roadways caused by hauling.

8. Provide effective dust control by sprinkling water, use of calcium chloride or other method approved by SEPTA Project Manager. Employ dust control when, where and in a manner required by SEPTA Project Manager.

C. Explosives and Blasting: Not permitted in performance of trenching work.

D. Hydraulic hoe-ram equipment may be used with written approval of SEPTA. Hoe-ram use may be limited as to time of day and size of unit.

E. Responsibility for Condition of Excavation: Assume responsibility for condition and results of excavation. Remove slides and cave-ins at whatever time and under whatever circumstance they occur.

F. Protection: Assume risks attending presence or proximity of overhead or underground public utility and private lines, pipes, conduits and support work, existing structures and property of whatever nature. Assume responsibility for damages and expenses for direct or indirect injury to structures or to person or property by reason of them or by reason of injury to them; whether structures are or are not shown on Drawings, by work of this Contract.

1. Outside Project Limits: Take necessary precautions to protect trees, shrubs, lawns and other landscaping from damage. Restitution work for damages rests solely with Contractor and at no expense to SEPTA.

2. Pipe Supports: Adequately support underground pipes or conduits exposed as a result of excavations. Provide adequate support along entire exposed length by timber or planking. Install supports in a manner that backfilling may be performed without dislodging pipes or
conduits. Place and carefully compact Coarse Aggregate around supports, and leave supports in place as a guard against breakage due to backfill settlement. No additional payment will be made for support material left in place or for labor of installing and maintaining supports.

G. Structure Supports: Where trenching past buildings or structures that by their construction or position might exert detrimental pressure upon trench, right is reserved by SEPTA Project Manager to require that buildings or structures, be underpinned or supported and protected, or special sheeting be driven, or that short lengths of trench be opened at one time.

H. Removal of Obstructions:

1. Remove, realign, or change direction of above or below ground utilities and appurtenant supports, if required in opinion of SEPTA Project Manager. Perform as extra work unless performed by owner of obstruction without cost to Contractor. However, uncover and sustain obstruction at no additional cost prior to final disposition of obstruction. No claims for damage or extra compensation due to presence of obstructions or delay in removal or rearrangement of obstructions will be made. Additional precautions concerning obstructions as follows:

   a. Do not interfere with persons, firms, corporations, or utilities employing protective measures, removing, changing, or replacing their property or structures, but allow taking measures necessary or advisable under circumstances, without relieving responsibilities of Contract.

   b. Without extra compensation, break through and reconstruct if necessary, invert or arch of sewers, culverts or conduits encountered if structure is in a position, in judgment of SEPTA Project Manager, as not to require its removal, realignment or complete reconstruction.

I. Advance Trenching: Where existing utilities or other suspected underground obstructions are within close proximity of proposed pipelines, uncover and verify exact location of obstructions far enough in advance of pipe laying to allow changes in pipe alignment or grade required to bypass obstructions and to avoid removing sections of pipe already installed. If sections of installed pipe require removal and reinstallation as a result of not verifying utilities or other underground obstructions far enough in advance, remove and reinstall pipe at no additional cost.

J. Excess Materials: No right of property in materials is granted for excavated materials prior to backfilling. This provision does not relieve
responsibility to remove and dispose of surplus excavated materials. Obtain written consent and any necessary permits and approvals before disposing of excess materials at an off-site location.

K. Borrow Excavation: Where required quantity of backfill exceeds quantity of suitable material excavated within limits of Project site, obtain sufficient material to complete backfill at no additional cost to SEPTA. If borrow excavation is needed, notify SEPTA Project Manager sufficiently in advance of borrow excavation requirements to permit SEPTA Project Manager to verify need for borrow excavation and to view proposed borrow pit and determine suitability of material to be provided. Borrow excavation from outside sources is subject to approval of SEPTA Project Manager. Obtain written consent and any necessary permits and approvals before use of borrow excavation from outside sources.

L. Change of Trench Location or Depth:

1. Should SEPTA Project Manager require a change in location of a trench from that indicated on Drawings due to presence of an obstruction, or from other cause, and change in location is made before excavation is begun, no extra compensation or claim for damages will be granted.

2. If a change in trench location made at requirement of SEPTA Project Manager involves abandonment of excavation already made, abandoned excavation, together with necessary refill is classed as unclassified excavation and backfill as applicable, in case full width of trench has not been abandoned.

3. If a change in trench location made at requirement of SEPTA Project Manager involves abandonment of excavation already made, abandoned excavation, together with necessary refill is classed as earth or rock excavation and backfill as applicable, in case full width of trench has not been abandoned.

4. If a changed location of a trench is authorized by SEPTA Project Manager upon Contractor's request, Contractor is not entitled to extra compensation or to a claim for damage. If change of trench location involves abandonment of excavation already made, abandoned excavation and refill is at Contractor's expense.

M. Classification of Excavated Materials: No consideration is given to nature of materials encountered in trenching operations. Therefore, no additional payment will be made for difficulties encountered in handling, disposal, or replacement of materials removed.

N. Bedding: Excavate trench and construct bedding as shown on the Construction Detail Drawings.
1. Excavate the trench to at least six inches below the required bottom of pipe. Excavate further if necessary, in the opinion of the SEPTA Project Manager, to reach suitable material for support of the utility.

2. Place AASHTO #8 bedding material, compacting in 4” layers to cover the bottom one-quarter of the pipe. Hand shape a cradle conforming to the bottom of the pipe.

3. Fill the spaces beside and over the pipe to a depth of 12” above the top of pipe. Where the pipe is rigid, tamp this material in layers 4” thick. Where the pipe is corrugated metal or plastic storm sewer pipe, avoid tamping directly over the pipe. See the Construction Detail Drawings.

O. Backfill: Install backfill on top of the completed bedding as shown on the Construction Details and as follows:

1. In areas under lawn or otherwise not paved nor exposed to vehicular traffic, fill the trench to one foot below finished grade with suitable backfill obtained from site excavation or imported. Backfill must be compacted in layers not to exceed 6”.

2. Complete filling the trench to finish grade with topsoil.

3. In vehicular areas, fill the trench above bedding with AASHTO #57 Coarse Aggregate, compacted in 6” layers, to subgrade elevation.

PART 2 PRODUCTS

2.01 MATERIAL

A. General: Reuse only materials free of topsoil, plant life, lumber, metal, refuse, coal waste, slag, and cinders. Remove all other material from the site.

B. Approved Backfill: On-site excavated soil or soil-rock mixed materials free of rocks or similar hard objects larger than six inches in any dimension. Rocks or similar hard objects may not represent more than 20 percent of backfill by volume.

C. Select Backfill: On site excavated material free of rocks or similar hard objects larger than one inch in any dimension.

D. Aggregate Backfill: AASHTO No. 57 Stone.

E. Pipe Bedding: AASHTO No. 8 Stone.
F. Concrete Cradle and Encasement: Per requirements of Cast-In-Place Concrete - Section 03300 and of Class B: 3000 psi.

G. Underground Warning Tapes: Printed polyethylene metallic detection tape, six inches minimum width, color coded, one inch minimum lettering, printed with name of utility buried below, and suitable for installation in all soil types.

1. Provide detection tape for the following pipe lines and utilities as installed or encountered:
   a. Sanitary Sewers – Green
   b. Storm Sewers – Green
   c. Sewage Force Main – Green
   d. Water Line – Blue
   e. Gas Line – Yellow tape plus a tracer wire where indicated by the Utility
   f. Electric – Red
   g. Telephone – Orange
   h. CATV Conduit – Orange
   i. Petroleum Line - Yellow

H. Flowable Backfill:

1. Cement: Type I or II conforming to PENNDOT Section 701.

2. Fine Aggregate: Type A, B, or C conforming to PENNDOT Section 703.1, except having a maximum loss of 20 percent in the Soundness Test.

3. Coarse Aggregate: Type C or better, AASHTO No. 10, conforming to PENNDOT Section 703.2.


5. Admixtures: Conforming to PENNDOT Section 711.3. Can be used when specifically approved.

6. Mix Design (Per Cubic Yard):
   a. Provide design mix in accordance with PENNDOT 704.1 (c).

8. Compressive Strength (PTM No. 604):
   a. 3 days: 500 minimum.
   b. 28 days: 900.

PART 3 EXECUTION

3.01 PERFORMANCE

A. Perform soil erosion control work in accordance with requirements of Section 02270.

B. Excavating: Perform excavation and backfilling using machinery except that hand excavation and backfilling may be required where necessary to protect existing structures, utilities, private or public properties. No additional compensation will be paid for hand excavation and backfilling instead of machine excavation and backfilling as may be necessary.

1. Remove surface materials of whatever nature, including pavement and topsoil, over line of trenches and other excavations and properly separate and store removed materials as suitable for use in backfilling or other purposes.
   a. Remove pavement in accordance with requirements of Section 02501 – Superpave Asphalt Mix HMA Paving and Surfacing.

2. Remove subsurface materials of whatever nature, including rock, masonry and cementitious materials, down to subgrade elevation. Properly separate and store removed subsurface materials as suitable for use in backfilling.

3. Remove rock to subgrade at least 25 feet in advance of pipe laying.

4. Excavate rock in miscellaneous excavations to extent required by SEPTA Project Manager.

5. When rock is encountered in excavations where blank connections are to be left for future extensions of waterlines, remove rock for a distance of not less than 10 feet from blank connection in direction of future extension. Excavate trench to specified width, depth, and length.

6. Remove and waste or otherwise dispose of excavated materials not required for backfill at no expense to SEPTA.
C. Trench Width and Depth: For full depth of trench, maximum trench pay width is a vertical plane as specified in Table A. If sheeting is required, following Table A dimensions apply to the inside face of sheeting.

<table>
<thead>
<tr>
<th>Diameter of Pipe</th>
<th>Maximum Trench Width (Outside Diameter of Pipe at Barrel Plus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 through 36 inches</td>
<td>24 inches</td>
</tr>
<tr>
<td>42 through 72 inches</td>
<td>30 inches</td>
</tr>
<tr>
<td>Larger than 72 inches</td>
<td>36 inches</td>
</tr>
</tbody>
</table>

1. Depth: Excavate below planned bottom of pipe, 4 inches in earth and 8 inches in rock.

2. No additional compensation will be paid for excavation beyond trench widths indicated in Table 'A' unless approved in writing by SEPTA Project Manager.

3. Excavate rock for manhole, chamber, catch basin, or other structure installations 1 foot outside exterior lines of structure walls and to a depth of outside bottom.

D. When unsuitable material is found below subgrade, as determined by SEPTA Project Manager, remove material to a depth determined by SEPTA Project Manager, and provide Class A Bedding compacted in 4 inch layers.

E. Length of Open Trench: SEPTA Project Manager has right to limit quantity of trench opened in advance of pipe laying and quantity of pipe laid in advance of backfilling, but in no case are these quantities to exceed 300 feet and 100 feet respectively. Complete trench excavation at least 25 feet in advance of pipe laying and keep trenches free from obstructions, except that at end of a work day or at discontinuance of work, pipe laying may be completed to within five feet of end of open trench. Additional open trench limitations as follows:

1. SEPTA Project Manager is empowered to require trench backfilling over completed pipe lines at any time if in his judgment it is necessary. No claim for extra compensation will be allowed for trench refilling even though work stopped elsewhere as a result.
2. If trenching work is stopped for any reason, except as required by SEPTA Project Manager, and excavation is left open for an unreasonable period in advance of construction in opinion of SEPTA Project Manager, SEPTA Project Manager may order trench refilling at no additional expense and not allow trench reopening until ready for actual use.

F. Excavated Material Storage:

1. In streets, roads, and highways, or in other locations where working space is limited, remove excavated materials from first 100 feet of opening as soon as it’s excavated, when required by SEPTA Project Manager. Store and return excavated materials for backfilling when required, at no expense to SEPTA. In no case cast excavated material beyond curb or right-of-way lines or on sidewalks or lawns.

2. Where more material is excavated from trenches than can be backfilled or stored on street, or within rights-of-way limits, leaving space for traffic and drainage, remove, and store excess material. Return excess material for backfilling when required, at no expense to Owner.

G. Subgrade Preparation: Provide Class A Bedding in trenches as pipe foundations. Depth of Bedding is indicated on Drawings. In lieu of Class A Bedding, provide concrete encasement or concrete cradle or other type of bedding as indicated on Drawings or required by SEPTA Project Manager. If maximum trench widths specified in Table A are exceeded, provide concrete cradle or concrete encasement at no expense to SEPTA.

H. Backfilling: Perform trench backfilling and backfilling excavations for other in line structures by methods resulting in thorough compaction of backfill material without displacement of grade and alignment of pipeline and its appurtenances and minimum settlement of backfilled material. Displacement of pipeline and settlement of backfill will be considered evidence of improper workmanship or inclusion of unsuitable backfill materials, or both, and will require re-grading and realigning pipeline and removing and re-compacting settled material at no expense to SEPTA. Following pipe bedding, piping, and inline structure installation, backfill trenches in following manner:

1. State Highway and Shoulder, Municipal Streets, Paved Entrances, Parking Lots, and Driveways: Aggregate Backfill compacted in 4 inch layers to bottom of temporary or permanent paving. If vibratory compaction equipment is used, lifts may be 8 inches.

2. Unpaved Shoulder Along Municipal Streets: If edge of trench is 3 feet or more from edge of road, backfill trench with Select Backfill
compacted in 4 inch layers flush with existing shoulder. If edge of trench is less than 3 feet from edge of road, backfill trench with Select Backfill within 18 inches from top of trench; remaining 18 inches to be backfilled with Aggregate Backfill; entire depth to be compacted in 4-inch layers, unless vibratory compaction equipment is used, then lifts may be 8 inches.

3. Unpaved Areas: Backfill trenches to a height at least 1 foot above top of outside barrel of pipe with Select Backfill material placed in 4 inch layers. If vibratory compaction equipment is used, lifts may be 8 inches. Carefully place this backfill in a manner not to damage or disturb pipe. Backfill remainder of trench with Approved Backfill compacted in 8 inch layers to bottom of topsoil. Replace topsoil to approximate depth of existing, as final refill operation and crown to height required by SEPTA Project Manager. Maintain crowned surface as required by SEPTA Project Manager, during guarantee period.

I. Compacting: During course of backfilling and compacting work, SEPTA Project Manager may, at any location or depth of trench, require Contractor to perform tests to determine whether compaction operations are sufficient to meet specified requirements. Trench excavation and backfill on state highways is subject to inspection by representatives of the Pennsylvania Department of Transportation (PENNDOT). Perform work in accordance with requirements of that department without additional payment regardless if requirements entail more labor or services than methods specified here. Similar inspection and requirements apply to Township and Borough street excavations. Compact trench backfill as follows:

1. Solidly tamp each layer of required backfill around pipeline with proper tamping tools made especially for this purpose.

2. Thoroughly compact aggregate backfill with a vibratory compactor of type and size satisfactory to SEPTA Project Manager and PENNDOT. Compacting of aggregate backfill by puddling or jetting is not permitted.

3. Use mechanical tampers to compact backfill materials in trench refill operations to produce a density at bottom of each layer of not less than 95 percent of maximum density obtained at optimum moisture content as determined by ASTM D698. Perform field determinations of density, in accordance with ASTM D6938. Make a minimum of two field determinations for each lift of backfill for every 200 ft. length of trench.
4. From a point one foot above top of pipe to subgrade of paving (or below surface where paving is not required), compact backfill by tamping. Use of Hydra-Hammer for compacting backfill in trenches is prohibited.

J. Flowable Backfill: Mix and transport in accordance with PENNDOT Section 704. Submit sequence of operations for approval prior to placement.

1. Testing and Acceptance: Conforming to PENNDOT Section 704.1(d) except as follows:
   a. Concrete for flowable backfill will be tested for slump in accordance with PTM No. 600, and for yield in accordance with PTM No. 613.
   b. Cylinders for compressive strength testing will be molded in accordance with PTM No. 611 and cured in accordance with PTM No. 611, Section 11.1.

K. Cleanup:

1. Remove surplus excavated material, rubbish and other construction debris, and keep removed to a point not more than 200 feet from head of open trench, unless otherwise authorized by SEPTA Project Manager.

2. After trenches and other excavations are backfilled and work completed, remove surplus excavated materials, rubbish, or other materials from work site. Dispose of materials off site in a lawful manner at no additional expense to Owner.

3. Evenly spread and leave in neat, smooth condition excavated material disposed of lawfully on public property.

4. Furnish and place topsoil, fertilize and seed grassed areas, within and outside rights-of-way affected by construction. Reseed and re-fertilize areas that fail to show a uniform stand of grass. Water, mow, rake, weed, and otherwise maintain grass until final acceptance of Contract.

5. Restore area covered by temporary and permanent Rights-of-Way to as near original conditions as is practical. Bring area up to original grade, place topsoil, seed, replant or replace shrubbery, repair or replace walks, driveways, fences and other improvements, damaged or removed.
6. When repaving over trenches and other excavations is completed, sweep paved surfaces affected by work using hand or power sweepers, and if required by SEPTA Project Manager, flush with water to remove dust and small particles.

7. In case Contractor fails or neglects to do so or makes unsatisfactory progress in doing so, within twenty four hours after receipt of a written notice from SEPTA Project Manager, SEPTA Project Manager may remove surplus material and clear roadways, sidewalks and other places, and expense for work charged to Contractor and deducted from moneys due or to become due him under Contract.

L. Maintenance: Assume responsibility for injury or damage resulting from lack of trench maintenance during guarantee period. If trench surfaces are not satisfactorily maintained or repairs begun within seven days after written notice from SEPTA Project Manager, repairs may be made by SEPTA Project Manager and cost charged against Contractor.

END OF SECTION
SECTION 02223

EXCAVATION, BACKFILL, AND COMPACTION FOR PAVEMENT

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. This section covers the excavation, backfill, and compaction for roadway pavement.

1.02 RELATED SECTIONS

A. Division 1 – General Requirements.

1.03 REFERENCES

A. PENNDOT Publication 408, Section 203.

PART 2 EXECUTION

3.01 PREPARATION

As per PENNDOT Publication 408, Section 203.3 and as shown on the contract drawings.

END OF SECTION
SECTION 02225
EMBANKMENT

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. This section covers the embankment for roadways.

1.02 RELATED SECTIONS
   A. Division 1 – General Requirements.

1.03 REFERENCES
   A. PENNDOT Publication 408, Section 206.

1.04 FIELD QUALITY CONTROL

PART 2 EXECUTION

2.01 PREPARATION
   As per PENNDOT Publication 408, Section 206.3 and as shown on the contract drawings.

END OF SECTION
SECTION 02228

MAINTENANCE AND SUPPORT OF EXISTING UTILITIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Coordination, maintenance, support, and protection and restoration requirements of existing public and private utilities affected by construction.

B. Existing Utility Facilities: Existing utility facilities include, but are not limited to the following:

1. Sanitary Sewer Distribution and Service.
2. Water Distribution and Service.
3. Electric Light and Power Facilities and Service.
4. Storm Sewer Distribution.

C. Related Sections:

1. Section 01010 – Summary of Work.
2. Section 01011 – Summary of Project.
3. Section 01041 – Project Coordination.
5. Section 01100 – Special Project Procedures.
7. Section 02050 – Demolition.
8. Section 02210 – Grading.
9. Section 02220 – Grading, Excavation, and Backfill.
10. Section 02222 – Excavation, Backfill, and Compaction for Utilities.
11. Section 02720 - Storm Drainage.
1.02 DEFINITIONS

A. Facility: Utility structures and system components belonging to a Utility Company including service lines which are used to provide service to the Utility’s customers and the product these facilities convey.

B. Utility: The company, agency, authority, owner, or operator of the facility concerned.

C. Abandoned: The use of existing facilities has been discontinued by the owners and operators.
   1. Demolish or remove these facilities insofar as they conflict with the proposed work.

D. To Be Abandoned: Use of a particular facility will be discontinued after written notice from the appropriate utility company or the SEPTA Project Manager has been received by the Contractor that the service is no longer required.
   1. Perform all work necessary to maintain service for as long as is required, which may include temporary support, rerouting, substitution of temporary facility or other required means. Demolish or remove these facilities insofar as they conflict with the proposed work after a written notification has been received from the owner.
   2. Abandon water and sewer facilities to remain in place only after receipt of a written approval.

E. Maintenance: Providing continuous and satisfactory service during construction.

F. To Be Maintained: The support and maintenance, in serviceable condition, of existing facilities during construction. It may include constructing permanent support, temporary support as indicated on the Contract Drawings, or other means necessary, as directed by the SEPTA Project Manager, to maintain continuous service utilizing the existing facility.

1.03 QUALITY ASSURANCE

A. Codes, Regulations, Reference Standards, and Specifications:
   1. Codes and regulations of the jurisdictional authorities.
   2. Published standards of owning utility agency.
1.04 SUBMITTALS

A. In accordance with Section 01300, submit the following:

1. Shop Drawings and Working Drawings:
   a. Submit working and shop drawings indicating plan and scheduling for performance of work to the appropriate utility for review and approval.
   b. Show actual location of existing facilities, interference which these facilities present to new work, proposed method of proceeding with actual construction and details of proposed support systems. Contractor’s support systems shall be constructed similarly to the detail shown on the Contract Drawings.
   c. Do not commence work until written approval has been received from the SEPTA Project Manager and the affected utilities.

2. Documentation:
   a. Notice of commencement of work:
      2) Give notice of at least two weeks and as otherwise required by the affected utilities prior to date of intended commencement of operations to parties having surface, subsurface or overhead structures and facilities in the construction area.
      3) Provide copies of notices to the SEPTA Project Manager.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Coordinate with the specified utility companies who are furnishing materials for the work to determine availability, locations, and required methods of storage and care of materials prior to incorporation into the work.

B. Transport, store, and handle materials in accordance with the requirements of the utilities.
1.06 JOB CONDITIONS

A. Location of Facilities:

1. Make every effort to indicate, properly, all existing utilities.

2. Prior to start of any work, contact the Pennsylvania One Call System (POCS) at 1-800-242-1776 in order to provide for locating and marking underground facilities.

3. Locations of existing facilities shown on the Contract Drawings are plotted from available records; however, these locations are not guaranteed.

4. Verify locations of facilities by field investigation within and adjacent to limits of project which may be affected by construction operations. Avoid damage or disruption of facilities during operation.

5. Upon encountering existing facilities which are not shown or upon ascertaining that a facility differs from that shown, determine ownership, use, and disposition of such facility and proceed as follows:

   a. If facility is abandoned or is to be abandoned, perform necessary work for either condition as shown or specified.

   b. If facility is to remain in service, perform support and restoration work in accordance with these specifications and the Contract Drawings.

6. Coordinate with SEPTA Project Manager and other applicable parties, if necessary.

B. Coordination with Utilities:

1. Establish direct and continual contact with the following list of Utilities and cooperate with them in all phases of work. Coordinate Contractor’s work schedule with that of the utility company’s schedule to perform work on the utility owned facility, so that conflicts and interruption of work sequence will be prevented.

   a. Telecommunications: Abovenet Communications
      337 Circle of Progress Drive
      Pottstown, PA 19464
      Telephone: (610) 326-3844
      Attn: Mr. Chris Ricciuti

      Qwest Communications
b. Electric: PECO Energy Company
400 Park Avenue
Warminster, PA 18974
Telephone: (215) 956-3038
Attn: Mr. Bill Nolthenius

c. Sanitary Sewer: Lower Bucks County Joint Municipal Authority
7900 Route 13
Levittown, PA 19057
Telephone: (215) 946-0731
Attn: Mr. Philip Smythe

2. Contact the Utility allowing sufficient time to accomplish the work they are required to perform giving special consideration to required lead times. Provide the Utility with the schedule of utility facility relocation/protection to permit coordination with the sequence of the work.

C. Responsibilities of Contractor:

1. Maintain and protect facilities.

2. Give notice of commencement of work as specified.

3. Notify the SEPTA Project Manager, and the utility of damage to facilities caused by construction operations. Pay for repair of such damage; damaged cables will be repaired or replaced as determined by the utility with all costs borne by the Contractor.

4. Provide accesses for inspection of facilities and for emergency involving utility services.

5. Permit free and clear access to utility personnel for purposes of inspection, maintenance, providing additional service and construction of new facilities.
6. Pay utility directly if, as an aid to the Contractor's construction, the utility performs work not shown.

7. When approved working or shop drawings show temporary facility provided for the Contractor's benefit, supply necessary materials, and perform necessary work.

D. If existing pipe is found to be encased with asbestos material, and the work of this contract does not involve any modification to this pipe nor does the work involve removal of asbestos material, proceed as follows:

1. Use a temporary barricade to protect the pipe from contact by contractor's personnel and equipment. If there is any disturbance or potential for disturbance of asbestos containing materials, or there is a potential for fiber release, or if any "asbestos abatement" operations are initiated, conform to the following regulations:

   a. PA Act 194 (63PS§2101, et seq) - Asbestos Occupations Accreditation and Certification Act.


   d. EPA Standards.

   e. PADEP Standards.

PART 2 PRODUCTS

2.01 MATERIAL

A. Backfill: In accordance with Section 02 220 and 02222.

B. Utility Facilities: As specified in other Sections of these specifications and as required by the Utility owner.

PART 3 EXECUTION

3.01 GENERAL

A. Maintain complete in place continuity of service, provide proper support, and protect utility facilities in accordance with the specifications of the utility affected.

B. Support facilities so as not to expose them to undue vibrations. Support and maintenance of these facilities will be subject to inspection by the utility.
C. Repair or replace public utilities damaged during construction at no cost to SPTA, to the satisfaction of the utility.

D. Assume the cost for repair or replacement of private utilities damaged during construction, which will be repaired or replaced by the private utility.

E. Conform to the specifications and standard practices of the affected utility owners. Coordinate with utility owners which work shall be done by Contractor and which work shall be done by the utility owner.

F. Provide, install, and maintain all temporary facilities required to provide interim utility service when a utility facility is to be relocated and when a utility facility to be replaced is abandoned prior to replacement.

3.02 EXCAVATION AND BACKFILLING OF UTILITY TRENCHES

A. Excavate and backfill utility trenches in accordance with Section 02222 and with the requirements of the affected utility.

B. Proceed with caution in areas of utility facilities; expose them by hand excavation or other methods acceptable to facility owner.

3.03 PAVEMENTS, SIDEWALKS, CURBS, AND GUTTERS

A. Where necessitated by utility trenches and in accordance with Section 02220, remove pavements, sidewalks, curbs, gutters, other existing features and those which may interfere with the work and may be directed to be removed by the SEPTA Project Manager.

B. Replace removed pavements, sidewalks, curbs, and gutters, other existing features required to be replaced or directed to be replaced by the SEPTA Project Manager, in accordance with other sections of these specifications.

C. Place temporary pavements where necessitated by sequence of operation.

3.04 UNSAFE AND UNSUITABLE UTILITY STRUCTURES

A. General Requirements:

1. If, upon exposure, condition or location of facility to be supported in place is found to be unsafe for maintenance or support, contact utility for repair or reconstruction procedures.

B. Electric, Communication, and Similar Type Facilities:
1. If structures containing electrical, communication and similar types of cables shown to be maintained complete in place are found upon exposure to be incapable of being maintained in place because of condition, location or both, contact utility for repair or reconstruction procedures.

2. When service box, manhole or conduit structure containing electrical or communication cables is broken away, contact utility for repair or replacement procedures.

3. Exercise care when working in vicinity of telephone structures containing coaxial cable which cannot withstand movement.

3.05 STORM AND SANITARY FACILITIES

A. Except for disconnects required as work of this contract, maintain service in sewer, house connections, and laterals at all times.

B. Prevent entry into sewers of material which might clog, damage, or otherwise interfere with operation of sewer.

C. See Sections 02720 and 02745.

3.06 WATER DISTRIBUTION AND SERVICES

A. Except for disconnects required as work of this Contract, ensure continuity of service, except as directed by SEPTA Project Manager. Arrange and coordinate such work so as to minimize interruption of service.

B. The Contractor shall make disconnects and perform repair or reconstruction work as needed or indicated and as specified in Section 02667.

C. Do not disturb, tamper with, or remove fire hydrants, water meters, meter pits, valves, and appurtenances without proper approval from SEPTA Project Manager.

3.07 ELECTRIC TRANSMISSION, DISTRIBUTION, AND SECONDARY FACILITIES

A. Except for disconnects required as work of this Contract, maintain continuity and integrity of existing facilities in accordance with the requirements of the electric power company.

B. If repair or reconstruction work is required due to damage or negligence by the Contractor, the Contractor shall pay the costs associated with the repair or reconstruction of the damaged facility.
3.08 TELECOMMUNICATIONS FACILITIES

A. Except for disconnects required as work of this Contract, maintain continuity of existing communication services of telephone company. Support and protect facilities during construction operations as approved by SEPTA Project Manager.

B. With the advance notice specified above, Contractor will make disconnects and will perform repair or reconstruction work of telecommunication facilities at no cost to the Contractor. If repair or reconstruction work is required due to damage or negligence by the Contractor, the Contractor shall pay the costs associated with the repair or reconstruction of the damaged facility.

END OF SECTION
SECTION 02230

SUBBASE COURSE

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. This section covers the preparation of subgrade and construction of a compacted aggregate subbase.

1.02 RELATED SECTIONS
   A. Division 1 – General Requirements.

1.03 REFERENCES
   A. PENNDOT Publication 408, Section 350.

PART 2 PRODUCTS

2.01 MATERIALS
   A. Aggregates: As per PENNDOT Publication 408, Section 350.2.

PART 3 EXECUTION

3.01 PREPARATION
   As per PENNDOT Publication 408, Section 350.3 and as shown on the contract drawings.

END OF SECTION
SECTION 02261A

REQUIREMENTS FOR TEMPORARY SHEETING AND SHORING TO SUPPORT AMTRAK TRACKS

PART 1 GENERAL

1.01 SCOPE

A. This engineering practice describes items to be included in the design and construction of temporary sheeting and shoring construction adjacent and proximate to Amtrak tracks.

B. Use of this specification is as required by Amtrak, as described in Amtrak Engineering Practice EP3014.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Section 02160: Excavation Support and Protection.

1.03 DEFINITIONS

A. Chief Engineer: Amtrak Vice President, Chief Engineer.

B. Railroad: National Railroad Passenger Corporation (Amtrak) and/or the duly authorized representative.

C. Engineering Practice: Amtrak Engineering Practices establish a system of uniform practices, notices, and instructions for the Amtrak Engineering Department, providing current, permanent, and temporary departmental procedures and policies.

1.04 SUBMISSION REQUIREMENTS

A. Unless otherwise directed in the Contract, the Contractor shall submit five sets of plans and calculations to the authorized representative of the Chief Engineer, Structures, whose name and address will be provided at the project pre-construction meeting.

B. Submitted calculations and plans shall be signed and sealed by a Professional Engineer registered in the Commonwealth of Pennsylvania.
C. The Contractor shall revise and resubmit plans and calculations as many times as necessary until a complete and correct site-specific work plan for crane/hoisting operations has been approved.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

3.01 CONTRACTORS INSTALLING TEMPORARY CONSTRUCTION SHEETING AND SHORING TO SUPPORT AMTRAK TRACKS SHALL CONFORM TO THE FOLLOWING

A. Footings for all piers, columns, walls, or other facilities shall be located and designed so that any temporary sheeting and shoring for support of adjacent track or tracks during construction will not be closer than toe of ballast slope. The dimension from gage of rail to toe of ballast, along tangent track, is 7'-5"; see dimensions on Track standard plans for curved track dimensions.

B. Use of Sheeting: When support of track or tracks is necessary during construction of the above-mentioned facilities, interlocking steel sheeting, adequately braced and designed to carry Cooper E80 live-load plus 50 percent impact allowance is required. Soldier piles and lagging will be permitted for track support ONLY when required penetration of steel sheet piling cannot be obtained due to site-specific conditions that make steel sheet piling placement impracticable in the opinion of the authorized Amtrak design review engineer.

1 For usual soil conditions and limited excavations, sheeting is required when the near-track excavation extends beneath or nearer to the track than the Theoretical Railroad Embankment Line. The Theoretical Railroad Embankment Line is defined as a line that starts at grade, ten foot from the centerline of the outer track, and extends downward, away from the track, at a slope of 1½ horizontal to one vertical.

2 For special soil conditions, such as soft organic soils and rock conditions, and for unusual excavation conditions, temporary supports for excavations may be necessary even when the limits fall beyond the Theoretical Railroad Embankment Line, requiring site-specific analysis by a professional geotechnical engineer.

3 See Sketch SK-1, “Normal Requirements for Sheet Piling Adjacent to Tracks.”
C. Exploratory trenches, three feet deep and 15 inches wide in the form of an “H,” with outside dimensions matching the proposed outside dimensions of sheeting, shall be hand dug, prior to placing and driving the sheeting, in any area where railroad or utility underground installations are known or suspected. These trenches are for exploratory purposes only and shall be backfilled and immediately compacted in layers. This work shall be performed only in the presence of a railroad inspector.

D. Absolute use of track is required while driving sheeting adjacent to running track. Track usage shall be prearranged per standard procedures through the Amtrak project representative.

E. Cavities adjacent to sheet piling, created by pile driving, shall be filled with sand, and any disturbed ballast shall be restored and tamped immediately.

F. Sheet piling cutoffs:

1. During construction, sheeting shall be cut off at an elevation no higher than the top of tie.

2. At the completion of construction activities involving the use of sheet piling, sheet piling may be pulled if there will be no adverse impact to the railroad track support bed as determined by the Amtrak site engineer. This will generally be permitted when both of these conditions are met:
   a. The sheeting face is at least ten feet distant from the centerline of track
   b. The bottom of the excavation that the sheeting supported prior to backfilling does not fall within an assumed influence zone under the tracks. The assumed influence zone is defined as the area, as seen in cross-sectional view, falling beneath the Theoretical Underground Track Disturbance Line. This line is defined as a line that starts at the end and bottom of the ties and extends from the track outward and downward at a one-to-one (45-degree) slope.

3. Sheet piling that is to be left in place shall be cut off below the ground line
   a. At least 18 inches below final ground line at the sheeting, and
   b. No higher than 24 inches below the elevation of the bottom of the nearest ties

4. See Sketch SK-1, “Normal Requirements for Sheet Piling Adjacent to Tracks.”
G. The excavation adjacent to the track shall be covered, ramped, and protected by handrails, barricades, and warning lights as required by applicable safety regulations and as directed by Amtrak.

H. Final backfilling of excavation shall conform to project specifications.

I. The Contractor shall provide Amtrak with a detailed schedule of proposed construction operations, detailing each step of the proposed temporary construction operations in proximity to Amtrak tracks, so that Amtrak may review and approve the proposed operations and may properly inspect and monitor operations.

J. Drawings for the proposed temporary sheeting and shoring shall be signed and sealed by a Licensed Professional Engineer. Complete design calculations, clearly referenced to the drawings and easy to review, shall be provided with submission of drawings.

K. Where site-specific conditions impose insurmountable restrictions to the design of temporary construction conforming to the limitations listed above, the design of temporary construction shall be developed in close coordination with Amtrak design review personnel. The Chief Engineer, Structures, shall provide final approval of temporary construction that does not conform to the above limitations.

1. When Amtrak grants approval for sheeting closer than standard minimum clearances, the Contractor shall develop a survey plan for the adjacent tracks, if not already required by the project, to be conducted prior to, during, and after the temporary sheeting construction operations. If settlement is detected, construction operations shall be suspended until the track has been returned to its initial condition and stabilized as determined by the Amtrak project site representative.

2. The Contractor shall stockpile ten (10) tons of approved ballast at the project site and maintain that amount in ready reserve to allow for the possible need to restore track profile.

L. Particular care shall be taken in the planning, design, and execution of temporary construction as relates to railroad slope protection and drainage facilities. Erosion and sediment control best management practices shall be designed and employed as approved by Amtrak. Any unintended disruption to railroad drainage facilities caused by the temporary construction shall be promptly remedied as directed by the Engineer, solely at the Contractor’s cost.

M. The following information sketch is attached:
1. Figure No. SK-1: Normal Requirements for Sheet Piling Adjacent to Track.

END OF SECTION
LEGEND

ZONE 1—ABOVE AND OUTSIDE THE THEORETICAL RAILROAD EMBANKMENT LINE.

ZONE 2—FARTHER THAN 10 FEET FROM THE CENTERLINE OF TRACK, BELOW THE THEORETICAL RAILROAD EMBANKMENT LINE AND ABOVE THE THEORETICAL UNDERGROUND TRACK DISTURBANCE LINE.

ZONE 3—BELOW AND INSIDE OF THE THEORETICAL UNDERGROUND TRACK DISTURBANCE LINE.

NORMAL REQUIREMENTS FOR SHEET PILING ADJACENT TO TRACK

1. EXCAVATIONS WITHIN ZONE 1 — ABOVE AND OUTSIDE OF THE THEORETICAL RAILROAD EMBANKMENT LINE — DO NOT NORMALY REQUIRE SHEETING TO PROTECT RAILROAD ROAD BED. SHEETING MAY BE REQUIRED FOR OTHER REASONS.

2. EXCAVATIONS WHOSE BOTTOMS EXTEND INTO ZONE 2 REQUIRE SHEETING, BUT THE SHEETING MAY NORMALY BE PULLED AFTER THE EXCAVATION HAS BEEN BACKFILLED.

3. EXCAVATIONS WHOSE BOTTOMS EXTEND INTO ZONE 3 WILL NORMALY REQUIRE THE SHEETING TO BE LEFT IN PLACE AND CUT-OFF PER REQUIREMENTS.
SECTION 02270
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Provision for soil erosion and sedimentation control work as indicated on Drawings. Work is fully described and detailed in Soil Erosion and Sedimentation Control Plan (SE&SCP) prepared for this Project.

B. Related Sections:
   1. Section 02212: Finish Grading.
   2. Section 02936: Seeding and Soil Supplements.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

B. ASTM International (ASTM):
   1. ASTM A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.


1.03 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Product Data: Submit catalog cuts and such other data as required to provide complete descriptive information for the following.
   1. Geotextiles.
   2. Super Silt Fence Filter Fabric.
   3. Fence.
   4. Erosion Control Matting.

C. Certificates:
   1. Inlet sediment control devices.
   2. Pumped water sediment control device.

D. Samples:
   2. Rock.

E. Delivery Tickets: Submit delivery tickets for further material verification.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Transport and handle Products, specified herein, in a manner recommended by the respective manufacturers of such, to prevent damage and defects.

B. Storage: Store Products in accordance with manufacturer's recommendations to prevent damage and contamination.
1.05 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Conduct the work of this Section in complete compliance with the requirements of the E&S Plan presented on the Drawings, and the rules and regulations of the following governmental agencies as may exceed the requirements of the E&S Plan:

1. Regulatory Agencies:
   a. The Pennsylvania Department of Environmental Protection.
   b. The Bucks County Conservation District.

PART 2 PRODUCTS

2.01 STONE FOR RIPRAP

A. Provide riprap obtained from an offsite source from an approved PENNDOT Type A source. Do not use stone for riprap protection containing boulders, or cobbles from soil or gravel deposits, earth, roots, debris, or similar material. Each stone to weigh not less than 162 pounds per cubic foot, based on saturated dry specific gravity, determined in accordance with ASTM C97.

B. Provide stone that is predominantly angular and blocky in shape rather than elongated, with sharp clean edges at intersection of relatively flat faces. Following shape limitations are specified for stone used for riprap protection.

1. Not more than 25 percent of stones reasonably well distributed throughout gradation to have a length more than 2.5 times breadth or thickness.

2. Do not use stone having a length exceeding 3.0 times its breadth or thickness.

C. Stone for riprap protection obtained from an offsite source to conform to gradation requirements for Rock Lining as specified in PENNDOT Section 850. "R" classification is as indicated on Drawings. Stone protection material may contain up to 5 percent, by weight of air dried rock, fragments, spalls, and dust with each particle weighing less than permissible minimum stone size and be defined as a stone in stone protection material. In computing percentages by weight of stones in required gradation, do not include weight of a particle weighing less than permissible minimum stone size in total weight.
2.02 BEDDING MATERIAL FOR RIPRAP

A. Aggregate Bedding Material for Corresponding "R" Classification of Riprap is as follows:

<table>
<thead>
<tr>
<th>&quot;R&quot; Class</th>
<th>Max. Size</th>
<th>Avg. Size (d50)</th>
<th>Min. Size (d15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-3</td>
<td>6&quot;</td>
<td>3&quot;</td>
<td>2&quot;</td>
</tr>
<tr>
<td>R-4</td>
<td>12&quot;</td>
<td>6&quot;</td>
<td>3&quot;</td>
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<tr>
<td>R-5</td>
<td>18&quot;</td>
<td>9&quot;</td>
<td>5&quot;</td>
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<tr>
<td>R-6</td>
<td>24&quot;</td>
<td>12&quot;</td>
<td>7&quot;</td>
</tr>
<tr>
<td>R-7</td>
<td>30&quot;</td>
<td>15&quot;</td>
<td>12&quot;</td>
</tr>
</tbody>
</table>

2.03 EROSION CONTROL DEVICES

A. Wire: ASTM A82.

B. Filter Fabric Fence: PENNDOT Section 865.2.

C. Rock Construction Entrance:
   1. Crushed Stone - PENNDOT Section 703.2, AASHTO No. 1.
   2. Filter Cloth - PENNDOT Section 735, Class 4.

D. Inlet Sediment Control Device (ISCD):
   1. Woven geotextile fabric sack sewn with double needle machine using high strength thread. Geotextile fabric sack to have an average width strength of 100 lb/in per ASTM D4884.
   2. Provide ISCD manufactured to fit openings of the inlets.
   3. Provide ISCD with integral dump straps, lifting loops and restraining strap.
   4. Properties:

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>TEST METHOD</th>
<th>TEST RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grab Tensile</td>
<td>ASTM D4632</td>
<td>300 lbs.</td>
</tr>
<tr>
<td>Grab Elongation</td>
<td>ASTM D4632</td>
<td>20 Percent</td>
</tr>
<tr>
<td>Puncture</td>
<td>ASTM D4833</td>
<td>120 lbs.</td>
</tr>
</tbody>
</table>
PROPERTY | TEST METHOD | TEST RESULT
--- | --- | ---
Mullen Burst | ASTM D3786 | 80 psi
Trapezoid Tear | ASTM D4533 | 120 lbs
UV Resistance | ASTM D4355 | 80%
Apparent Opening Size | ASTM D4751 | 40 US Sieve
Flow Rate | ASTM D4491 | 40 Gal/Min/Sq. Ft.
Permittivity | ASTM D4491 | 0.55 sec-1

All properties are minimum average roll values.

5. Manufacturer:
   a. ACF Environmental, Siltsack.
   b. Or approved equal.

E. Curbed Roadway Inlet Protection: DEP Erosion and Sediment Pollution Control Program Manual Details and Notes and Detail Drawings.

F. Rock Filters: DEP Erosion and Sediment Pollution Control Program Manual, Chapter 5, Section 11.

2.04 TEMPORARY SEEDING MIXTURES
A. As indicated on the Drawings.

<table>
<thead>
<tr>
<th>Variety of Seed</th>
<th>Spring Mar. 1-May 15 lb. per acre</th>
<th>Summer May 15-Aug. 15 lb. per acre</th>
<th>Fall &amp; Winter Aug. 15-Mar. 1 lb. per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual rye grass</td>
<td>20</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Barley or Oats (local seed)</td>
<td>96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Millet (Japanese)</td>
<td></td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Annual rye grass</td>
<td></td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Winter rye or</td>
<td></td>
<td></td>
<td>168</td>
</tr>
<tr>
<td>Winter wheat</td>
<td></td>
<td></td>
<td>180</td>
</tr>
</tbody>
</table>
2.05 SOIL SUPPLEMENT MATERIALS
   A. As specified in Section 02936.

2.06 MULCHING MATERIALS
   A. Mulches: As specified in PENNDOT Section 805.2(a)1.
   B. Mulch Binding: As specified in PENNDOT Section 805.2(b).
   C. Wood Chips: Wood chips recovered from clearing and grubbing operations are acceptable as mulch for seeding and used at a rate of 35 cubic yard per acre.

PART 3 EXECUTION

3.01 EXAMINATION
   A. Site Verification of Conditions:
      1. Examine the Site, comparing existing conditions at the Site to the approved Erosion and Sedimentation Control Plan (E&SCP) for this Contract, to determine what else may be necessary to prevent water pollution due to erosion.
      2. If the Contractor desires to modify the approved Erosion and Sedimentation Control Plan or Post Construction Stormwater Management Plan, necessary approvals must be obtained prior to implementing the provisions of the modified Plan(s).
         a. Employ a licensed Professional Engineer to perform the engineering design work required to modify the Erosion and Sedimentation Control Plan and Post Construction Stormwater Management Plan.
         b. An alternate Erosion and Sedimentation Control Plan or Post Construction Stormwater Management Plan must provide equal or better erosion and water pollution control than the originally approved plans at no increase in the Contract Price.
            1) Design the surface drainage systems so they do not cause erosion on or off of the Site, and do not cause an unwanted flow of water.
            2) Design sediment traps to have a capacity of 2000 cubic feet per contributing acre.
c. A new earth disturbance permit must be obtained and filed with the Bucks County Soil Conservation District pursuant to the Municipal and County Notification (Permit Application), Act 14, P.L. 834.

d. Submit the alternate Erosion and Sedimentation Control and Post Construction Stormwater Management Plans showing the proposed alternate erosion and sediment controls to the Bucks County Soil Conservation District and the SEPTA Project Manager for approval.

1) For complex projects, hold a pre-application meeting to ensure a quality plan submittal.

3.02 INSTALLATION

A. Super Silt Barrier Fence:

1. Provide super silt barrier fence at the locations indicated on the Contract Drawings.

   a. Excavate a shallow 8 inches deep by 6 inches wide trench, and drive support posts vertically into the downstream side of the trench until the bottom end reaches a minimum depth of 36 inches as indicated on the Contract Drawings.

   b. For super silt barrier fence, provide chain link fence with 2 inch mesh fabric to support the super silt barrier fence’s geotextile fabric, and guy wires extending from the tops of the support posts to ground anchors partially buried in the ground on the upstream side of the silt barrier fence to support the posts.

   c. Fasten the chain link fabric mesh fencing to the 2 ½ inch diameter galvanized or aluminum support posts using fasteners as required.

   d. Attach the geotextile fabric to the posts and mesh fencing support while keeping sag to a minimum.

   e. Use No. 7 tension wire on top and bottom of chain link fence.

   f. Backfill and compact the trench with the excavated material burying the bottom of the geotextile fabric in the ground to provide a barrier to prevent eroded sediment from passing the super silt barrier fence.

B. Rock Barriers:
1. Construct rock barriers at the locations indicated on the Contract Drawings.

C. Rock Filter Outlet:

1. Construct rock filter outlet at the locations indicated on the Contract Drawings and as detailed on the Contract Drawings to form an upstream sedimentation pond.

   a. Determine the width and depth of the ditch or depression slope the rock filter outlet will dam, and evenly distribute rock pieces across the ditch or depression to construct a mound of rock with a minimum of voids.

      1) Construct the rock filter outlet across the ditch or depression so it reaches a height 1/2 the depth of the ditch or depression on each side, and dips from each side until its height is 6 inches less at the midpoint of the ditch or depression.

      2) Construct the rock filter outlet to have a somewhat flattened top that is 1-foot across in the direction of flow and slopes down to the bottom on both the upstream and downstream sides with 2:1 slopes.

   b. Construct a filter blanket on the upstream side of the rock filter outlet from AASHTO Number 57 coarse aggregate that is 1-foot thick in the direction of flow as shown on the Contract Drawings.

D. Construction Entrance Construction:

1. Construct each construction entrance as shown on the Contract Drawings and to the depths indicated.

   2. Course Aggregate:

      a. Provide coarse aggregate conforming to the requirements specified in AASHTO M 80 for Size Number 57.

      b. Provide coarse aggregate conforming to the requirements for Size Number 1 as specified in AASHTO M 80.

3.03 FIELD QUALITY CONTROL

A. Inspection:
1. Inspect temporary sedimentation control structures after each storm, and make repairs as necessary.

2. The rock samples provided for rock barriers will be used as a reference for judging the size and gradation of the rock supplied and placed.

3.04 CLEANING

A. Remove accumulated debris from erosion and sediment control structures prior to restoring the areas.

3.05 RESTORATION

A. Do not remove temporary sedimentation and erosion controls prior to receiving the SEPTA Project Manager’s and Bucks County Conservation District’s permission to do so.

B. Remove the temporary sedimentation and erosion controls installed under this Section when they are no longer needed to prevent erosion, when they interfere with construction activities, or when the SEPTA Project Manager directs their removal.

1. Remove the silt barrier fence when it is no longer needed, and restore the area to its original condition.

2. When inlet protection, rock filters and sumps are no longer required, backfill them with granular material, concrete, or other material approved by the SEPTA’s Project Manager.

C. Repair:

1. Maintain the stored areas of the construction entrance and sediment trap areas by replacing or cleaning fouled areas as required and as directed by the SEPTA Project Manager.

D. Remove all controls prior to Final Acceptance.

END OF SECTION
SECTION 02400
SOILS MANAGEMENT

PART 1 GENERAL

1.01 DESCRIPTION

A. The Work of this Section includes, but is not limited to the handling, storage, transportation, and disposal of excess soils associated with Specification Section 02220, Grading, Excavation, and Backfill.

1.02 RELATED WORK

A. All appropriate Sections of Division 1, Division 2, and Division 3 of these Specifications.

1.03 JOB CONDITIONS

A. Previous soil investigations have been performed at the Levittown Train Station to determine if subsurface contamination related to the previously removed underground storage tank (UST) still exists. In 1992 three monitoring wells were installed to evaluate the impact to groundwater from the leaking heating oil UST. In 2007 Earth Tech/ AECOM conducted soil borings around the former UST location at the Levittown Train Station and collected soil samples for chemical analysis. Soil samples collected to the northeast of the former UST location (SB-1) detected benzene at 3.06 mg/kg, naphthalene at 332 mg/kg, cumene at 23.68 mg/kg. On February 24, 2009 Earth Tech/ AECOM installed an additional monitoring well on site to facilitate the recovery of floating heating oil from the groundwater. Gannett Fleming collected a soil sample during well installation (MW-4) detecting benzene at 0.73 mg/kg, benzo(a)pyrene at 9.6 mg/kg, naphthalene at 36 mg/kg. The objective was to determine if the soils contaminated with heating oil from the former UST could be classified as Pennsylvania Clean Fill, the results listed above are above Pennsylvania Clean Fill parameters. Gannett Fleming also collected samples from other areas not impacted by the former leaking UST and analyzed these samples for Waste Characterization parameters in order to adequately characterize these soils to determine acceptance at Clean Earth Inc. and/or Waste Management facilities or approved equal. Copies of the reports presenting sampling locations, field sampling and analytical methods is presented in “Attachment I – Background Information.”

B. Soil sampling results indicate that the soils to be excavated on the project will not meet Pennsylvania Clean Fill criteria; however, the soils can be
disposed of at Clean Earth of Philadelphia as historic fill and at Waste Management’s GROWS facility as residual waste.

1.04 SUBMITTALS

A. The Contractor shall submit proof of qualifications for its proposed transportation contractor(s) for excess soils and liquids in accordance with Paragraph D of this Specification and related Specification Sections.

B. The Contractor shall submit proof of qualifications for its proposed disposal facility(ies) for soils and liquids to be removed from the site in accordance with Paragraphs E and F of this Specification and related Specification Sections.

C. The Contractor shall provide SEPTA with all records including manifests and certificates of disposal for all excess soils and liquids to be removed from the site.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall comply with the requirements of the Specifications. Should conditions arise that are not covered by these documents, the Contractor shall immediately notify SEPTA.

B. Limits of excavation shall be as directed by SEPTA.

3.02 EXCESS SOILS

A. The Contractor shall perform excavation of soils in accordance with Specification Section 02222.

B. On-Site Storage

1. SEPTA will not allow temporary staging of soils generated as part of Specification Section 02222. The Contractor shall direct load all excess soils resulting from excavation activities that cannot be reused onsite for offsite transportation and disposal.

C. Loading

1. The Contractor shall furnish all equipment necessary for loading of excess soils in an effective and safe manner. Loading areas shall be designed to contain any spillage. The Contractor is responsible for
removing any spillage or leakage outside of areas of excavation at no additional cost to SEPTA.

2. All vehicles used to haul excess soils shall be delivered to the Site in a completely clean manner, and shall be cleaned prior to first use. Records and documentation of cleaning/decontamination for each vehicle shall be kept on file by the Contractor for the duration of the project.

3. The Contractor shall implement measures to strictly control dust, odors, and spills during the transport of excavated materials. The Contractor shall use covers/tarps to prevent the release of dusts and odors from trucks or other equipment, as necessary.

4. All vehicles hauling excess soils shall be inspected by the Contractor following loading. No dripping or leaking of any quantity of material is allowed. Soils that contain excess moisture may be blended with drier materials to reduce their water content. Blending shall occur as part of loading activities at no additional cost to SEPTA. The hauling vehicles shall be sealed tightly in accordance with Federal, State, and local codes to prevent the release of materials during transport. Vehicles shall not be overloaded.

5. All vehicles shall be inspected by the Contractor to assure no excess soil adheres to its wheels or undercarriage to avoid tracking of soils. Exteriors of all vehicles must be cleaned prior to leaving the site.

D. Transportation

1. All excess soils must be transported off-site only to the facility(ies) pre-approved by SEPTA during the bidding process.

2. Transportation shall be provided in accordance with Department of Transportation (DOT) Hazardous Materials Regulations and State and local requirements.

3. The Contractor shall submit proof of qualifications that its proposed waste transportation contractor is licensed and permitted in all states and Canadian provinces through which they will travel with decals/placards appropriate for the excess soils and liquids removed from the Project. This includes having a PADEP Waste Transporter Authorization issued under Act 90. The Contractor shall also submit documentation of Department of Transportation (DOT) training requirements, a list of vehicles and DOT approved containers which will be available for use on the project, DOT violation history and a list of other projects similar in magnitude to this project with contact names and telephone numbers.
4. The Contractor shall minimize storage of excess soils on SEPTA property by transporting excavated soils directly to the approved disposal facility when schedule and conditions prove practicable.

5. The Contractor is responsible for obtaining fully executed manifests and certificates of disposal from the facility(ies) approved by SEPTA. This documentation must be maintained by the Contractor for the duration of the project, with copies supplied to SEPTA. The Contractor shall maintain the log of all manifests with corresponding truck numbers and waste weights onsite at all times for SEPTA inspection.

6. The Contractor is responsible for controlling any possible tracking or spilling of materials on public roadways and shall perform all cleanup if such occurs at no additional cost to SEPTA.

E. Disposal

1. Excess soils disposal will be at a SEPTA-approved facility(ies). This shall be the same facility(ies) proposed ten (10) days after bid opening and approved by SEPTA.

2. Disposal of excess soils shall occur in accordance with all local, State, and Federal laws and regulations.

3. The Contractor shall submit proof of qualifications that the Bidder’s proposed disposal facility(ies) is permitted for the soils to be removed from the project for off-site disposal. It is recommended that the Contractor use Clean Earth, Inc. (soils classified as historic fill) or Waste Management, Inc.’s GROWS facility (soils classified as residual waste) as the proposed disposal facility for soils removed from the project and requiring off-site disposal. The Contractor shall submit copies of the current permits for the facility. The Contractor shall also submit the name and telephone number of the primary contact at the state regulatory agency that issued the permit, a copy of the most recent inspection report from the disposer state, a history of any violations/orders/deficiencies and their resolution, financial assurance documents and a list of major customers with contact names and phone numbers. In addition, the Contractor may submit an alternative proposed waste disposal facility subject to the requirements of these Specifications. Disposal shall not occur until written approval is provided by SEPTA.

4. The Contractor shall maintain and provide SEPTA with all records (fully executed manifests and certificates of disposal) for all soils and liquids taken off-site.

F. Water/Liquids Management
1. The Contractor shall minimize the amount of water in the area of excavation by employing diversion berms or other approved applicable techniques. The excavation area should be limited to the boundaries shown in the Specifications or as directed by SEPTA. The Contractor must ensure that minimal disturbance is caused by diversions and proper controls are employed to minimize erosion and sediment transport. Surface runoff, seepage, or groundwater shall be managed according to Section 02220 – Grading, Excavation and Backfill and the reviewed and approved Contractor’s Site Management Plan.

2. All water used for cleaning of the Contractor’s equipment shall be collected for discharge according to Section 02220 or collected into 55-gallon drums or other suitable watertight containers for further testing and disposal by the Contractor at a SEPTA-approved facility, and at no additional cost to SEPTA.

3. If Contractor chooses to dispose of collected water at a SEPTA-approved facility than Contractor shall submit proof of qualifications that its proposed facility(ies) is/are permitted for the treatment/disposal of water and liquids generated from the work activities. The Contractor shall submit copies of the current permits for the facility(ies). The Contractor shall submit the name and telephone number of the primary contact at the state regulatory agency that issued the permit, a copy of the most recent inspection report from the disposer state, a history of any violations/orders/deficiencies and their resolution, financial assurance documents, and a list of major customers with contact names and phone numbers. Disposal shall not occur until written approval is provided by SEPTA.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY
A. Section includes: Furnishing all designs, materials, equipment, labor, and manufacturing techniques for testing and installation of minimum 7-inch diameter micropiles.

1.02 REFERENCES
A. ASTM International (ASTM):
   4. ASTM A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

B. Federal Highway Administration (FHWA):

C. American Welding Society (AWS)
   1. AWS D1.1 Structural Welding Code-Steel.
   2. AWS D1.2 Structural Welding Code-Reinforcing Steel.

D. Related Sections:
   1. Section 02010 – Subsurface Investigation.
   2. Section 02190 – Site Monitoring.

1.03 SUBMITTALS

A. Contractor Qualifications: The micropile contractor will be experienced in the design, construction, and load testing of micropiles. Submit documentation to exhibit successful completion of no less than five (5) micropile projects in the past five (5) years of similar scope and size. Include a brief project description, including soil and rock descriptions, with owner’s name, current phone number, and micropile construction details for each of the previous micropile projects.

B. Shop Drawings: Submit layout drawings indicating proposed installation sequence of micropiles. On this sequential layout, indicate each pile identification, its installation sequence number, type, size, and final tip elevation.
   1. Indicate pile layout details, member size and splicer fittings, and pile splice details.
   2. Use standard welding symbols of the American Welding Society on shop drawings.

C. Submit detailed written description of the proposed micropile construction procedure, include list of equipment to be used and plan describing the control/disposal of surface water, drill flush and excess waste grout. The micropile detail shall include design load, type, and size of permanent casing, reinforcement steel, bond zone length, pile length, and top attachment. Include a step-by-step description of the proposed micropile construction procedure, including personnel, testing, and equipment to assure quality control. This step-by-step procedure shall be shown on the shop drawings in sufficient detail to allow the Project Manager to monitor construction and quality of the micropiles.
D. Submit mill test reports for steel pipe and bar reinforcement showing the results of tests conducted in accordance with the ASTM International Specifications.

1. Submit guarantee all steel used for this project is American-made.

E. Submit grout design mix for approval prior to the production of grout; include test results for the proposed grout mix. Test results shall be from projects completed within one year from start of this project.

F. Submit grouting plan with complete description and details for the following:

1. Methods and equipment for accurately monitoring and recording the grout depth, volume, and pressure as grout is placed.

2. Procedure and equipment for Contractor monitoring of grout quality.

G. Submit plan for the proposed micropile load testing method, include drawings, details, and structural design calculations. Submittal shall be signed and sealed by a Professional Engineer registered in the Commonwealth of Pennsylvania. The plan shall include the following:

1. Method of applying the load.

2. Load cell calibration reports, as applicable.

3. Reaction frame design and details.

4. Reaction frame piles and configuration.

5. Placement and support of measuring devices.

6. Location of pile load test area.

H. Submit full-length installation records for each micropile installed within one workday after the pile installation is completed.

1. Separate log shall be provided for each micropile.

2. The submitted records shall include: date of installation, pile drilling duration, final tip elevation, total micropile length, grout quantity injected, pile materials and description of unusual conditions.

I. Submit design calculations for the micropile system. The submittal shall be stamped by a Registered Professional Engineer in the Commonwealth of Pennsylvania.
J. Do not begin micropile operations until the appropriate submittals have been accepted in writing. Do not start work, or order materials until acceptance of the Contractor’s experience qualifications is received in writing. Work may be suspended by SEPTA if the Contractor uses non-accepted personnel.

K. In the event that the Contractor elects to change or modify the personnel, equipment, methods, or procedures approved within the submittals described above and/or resulting in potential alterations to the design assumptions or installation techniques during the installation of micropiles, the Contractor shall resubmit, to the Project Manager, all previously approved submittals for the work. Micropile installation will not commence until review of submittals and written approval by the Project Manager is received. In this event, the Project Manager reserves the right to direct, at the Contractor’s expense, additional testing to support approval of the revised submittals reflecting all changes and modifications.

1.04 ALLOWABLE TOLERANCES

A. Installation Tolerances:

1. Centerline of micropiles to be within 3 inches from indicated plan location.

2. Pile shall be plumb within 2 percent of total length plan alignment.

3. Top elevation of pile shall be plus 1 inch or minus 1 inch maximum from vertical elevation indicated.

4. Centerline of reinforcement steel shall not be more than ½ inch from indicated location.

1.05 DESIGN CRITERIA

A. The micropiles shall be designed to meet the specified compression and tension capacity defined on the Contract Drawings. The calculations and drawings required shall be submitted to the Project Manager for review and acceptance.

B. The overall length of a micropile will be selected such that the required compression capacity is developed by skin friction between grout and soil over a suitable length of bond zone in soil.

C. Design the micropiles and pile top to footing connections using the procedures and requirements contained in FHWA “Micropile Design and Construction”, Report No. FHWA NHI-05-039. Use allowable stresses as specified herein. Structural design of any individual elements not covered by the FHWA manual shall be by the service load design method in
conformance with the design references specified in 1.05.D. The allowable stresses at working load shall not exceed the following values:

1. **Compression Loads:**
   
a. The allowable stress on the cement grout shall be thirty-three (33) percent of the twenty-eight (28) day unconfined compressive strength.
   
b. The allowable stress on the steel reinforcing, including permanent steel casing, shall be forty (40) percent of the minimum specified yield strength.
   
c. The maximum allowable stress on the steel shall be 32,000-pounds/square inch.
   
d. The reinforcing steel shall be designed to carry not less than (60) percent of the design compression load.

2. **Tension Loads:**
   
a. The allowable stress on the steel reinforcing shall be fifty-five (55) percent of the minimum specified yield strength.
   
b. The allowable stress on the cement grout shall be zero.

D. The micropile top attachment shall effectively distribute the design load to the pile cap, such that the concrete bearing stress does not exceed ACI 318 Building Code and the bending stress in the steel plates does not exceed AISC Allowable stresses for steel members.

### 1.06 PROJECT CONDITIONS

A. Use the estimated bond zone length on the Contract Drawings to prepare the bid price for the micropiles.

1. Additional test borings and other exploratory operations may be made by the Contractor, at no cost to the Owner, provided such operations are acceptable to the Owner.

2. Should the total pile lengths be more or less than the lengths based on the estimated rock socket length, an adjustment would be made in the lump sum price bid under which the work was performed.

B. The micropile Contractor shall verify the locations of all utilities (in-ground and above ground) that may affect the work area. The Contractor shall take the necessary precautions to avoid all existing utilities. Any damage
done to the existing utilities shall be immediately repaired by the Contractor at no cost to the owner.

C. The Contractor shall interpret the surface and subsurface conditions that may affect methods or costs of execution of work. Available data concerning subsurface materials or conditions, provided with Section 02010, has been obtained by the retained Engineer for its own use in designing this project. Its accuracy or completeness is not guaranteed by SEPTA or the Engineer and in no event is it to be considered as part of the contract plans or specifications. Contractor must assume all risks in excavation for this project and shall not be entitled to rely on any subsurface information obtained from the retained Engineer. Bidders shall therefore make their own investigation of existing subsurface conditions and if they do not do so, the Owner will not be responsible in any way for the consequences.

D. Monitor site during installation of micropiles in accordance with Section 02190.

1.07 QUALITY CONTROL

A. Meet at the job site prior to the beginning of pile fabrication.

B. Attendees shall include: Construction Manager, Pile Contractor, Installer (if different), Geotechnical Engineer, and the Quality Assurance Agency.

C. The purpose of the meeting is to review conflicts related to the installation of micropiles, coordinate layout, and other related topics as determined by the Geotechnical Engineer and the Project Manager.

1.08 QUALITY ASSURANCE

A. Quality Assurance Agency shall monitor all micropile installations, including the verification load test.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcement Pipe: Steel pipe conforming to ASTM A252 Grade 3 with minimum yield strength of 80 ksi. May be new “Structural Grade” (a.k.a. “Mill Secondary”) steel pipe meeting requirements herein but without Mill Certification, free from defects (dents, cracks, tears) and with two coupon tests per truckload delivered to the fabricator.

1. Welded seams and splices shall be complete penetration welds. When welded for structural purposes the following material conditions apply:
a. The carbon equivalency (CE) as defined in AWS D1.1, Section XI5.1, shall not exceed 0.45, as demonstrated by mill certifications.

b. The sulfur content shall not exceed 0.05%, as demonstrated by mill certification.

2. Threaded couplers are not permitted for splicing the reinforcement pipe.

3. Threaded casing joints shall develop at least the required compressive and tensile strength used in the design of the micropile.

B. Grout: Neat cement grout with a minimum 28-day compressive strength of 4,000 psi per ASTM C109.

1. Cement: Type I, II, or III manufactured in accordance with ASTM C150.

2. Water/Cement Ratio: 0.40 to 0.50.

3. Admixtures, if used, shall conform to ASTM C494; accelerators will not be permitted.

   a. Admixtures shall be compatible with the grout and mixed in accordance with the manufacturer’s recommendations.

C. Steel Plates and Shapes: ASTM A36 or ASTM A572, Grade 50.

D. Centralizers: Fabrications made from Schedule 40 PVC pipe or tube, steel, or material non-detrimental to the reinforcing steel.

   1. Securely attach centralizers to the reinforcement; sized to position the reinforcement within ½ inch of plan location from the center of the pile.

E. Bar Reinforcement: ASTM A615 Grade 75, or ASTM A722 Grade 150.

   1. Bar couplers, if required, shall develop the ultimate tensile strength of the bars.

PART 3 EXECUTION

3.01 MICROPILE INSTALLATION

A. General: Contractor shall select the drilling method, the grouting procedure, the grouting pressure, and the load test equipment to construct the micropiles.
1. Drilling equipment and methods shall be suitable for drilling through the conditions to be encountered.

2. Drill hole must be unobstructed along its full length and width prior to placing grout and reinforcement.

3. Temporary casing or other approved methods of pile drill hole support will be required. Use of drilling fluid containing bentonite is not allowed.
   a. Proposed methods for drill hole support and for prevention of detrimental ground movement shall be submitted to and approved by the Project Manager.

4. Pre-drilling the borehole and allowing hole to stand open until structural casing is placed is not acceptable.

5. Micropile lengths will be measured from the cutoff elevation to the pile tip.

B. Control on-site, surface and drilling flush water by immediately removing from site by gravity flow or pumping such that collection of water does not occur within or near the platform footprint, building footprint or track area. Prevent any flow of surface water into previously drilled pile locations. Dispose of on-site and drilling flush water in accordance with approved Erosion and Sedimentation plans and local, state and federal regulations and standards.

1. Dispose of water in a suitable manner approved by the Project Manager so as to avoid damage to adjacent property, existing structures and all work under construction. Do not pump drainage water onto the streets.

2. Install oil/water separator in the event floating petroleum product is encountered. SEPTA has been remediating the site of a localized heating oil product floating plume associated with former station underground storage tank as described in the Soils Management Section 02400.

3. Provide and maintain, settling basins and sumps for catching and holding settleable matter. These shall be frequently cleaned and maintained. Wherever water-containing mud, clay, sand or other material in suspension, is pumped from the excavations, make suitable provision to insure that the flow will be unobstructed. Take precautions to avoid pumping water through freshly placed concrete.

4. Do not allow water to accumulate at pile locations.
C. Reinforcement/Pipe Installation:

1. The Contractor is responsible for maintaining an open hole. Under no circumstances shall the area above the bond zone be left open and unsupported.

2. Advance pile to the required depth as determined; contact between the drill casing and the borehole shall be maintained.

3. Internal rods shall be withdrawn and the pile shall be filled internally with grout after casing reaches determined pile tip elevation.

4. Provide centralizers on central reinforcement at maximum 9 feet on center; the upper and lower centralizer shall be located 3 feet maximum from each end of reinforcement.
   a. Centralizers shall permit free flow of grout without misplacement of reinforcement.
   b. Partially inserted reinforcement bars shall not be driven or forced into the hole.

5. Contractor shall check pile top elevations and adjust all installed micropiles to the plan elevations.

6. Spliced casings shall be secured in a manner to avoid eccentricity or angle between the axis of the two lengths spliced.

D. Grouting:

1. Grout micropiles the same day the load transfer bond zone length is drilled.

2. Grout shall be free of lumps and undispersed cement.

3. Place grout within one hour of mixing in one continuous operation.

4. Inject grout from the lowest point of the drillhole and continue until uncontaminated grout flows from the top of the pile. Extract temporary casing, in stages ensuring that, after each length of casing is removed the grout level is brought back up to the ground level before the next length is removed. The tremie pipe or casing must always extend below the level of the existing grout in the drill hole. Control grout pressures and grout takes to prevent excessive heave or fracturing of soil formations. Upon completion of grouting, the grout tube may remain in the hole, but must be filled with grout.
5. Contractor shall have method of measuring grout quantity and pumping pressure during grouting operation. Equip the grout pump with a pressure gauge to monitor grout pressures. Place a second pressure gauge at the point of injection at the pile top. The pressure gauges shall be capable of measuring pressures of at least 150 psi or twice the actual grout pressures used, whichever is greater.

6. If the Contractor elects to use a post-grouting system, shop drawings and construction procedure details shall be submitted in accordance with 1.03.

3.02 TESTING

A. Test grout strength in accordance with ASTM C109 at a frequency of no less than one test per day or one test for every 10 piles, whichever occurs more frequently.

1. Test shall consist of 3 grout cubes; compressive strength shall be the average of the 3 cubes.

B. Test grout density in accordance with ASTM C188 at a frequency of one test per pile. The grout density measured in the field shall be within 5% of grout density of the approved mix design.

C. Perform one verification compression test on an initial production micropile prior to the installation of other production piles, at location directed by the Project Manager. Test verification pile to a maximum test load 2.0 times the micropile design load.

1. Compression Test according to ASTM D1143, Quick Load Test Method.

2. Test is to verify installed micropile meets the required compression load capacity and to verify the length of micropile load transfer bond zone is adequate.

3. Verification load test results must be approved by Project Manager prior to installation of production piles.

4. Drilling and grouting method, casing length, outside diameter, reinforcement pipe, grout, and depth of embedment for the verification test pile shall be identical for the production piles.

5. The maximum verification test loads applied to the micropile shall not exceed 80 percent of the structural capacity of the micropile structural elements, to include steel yield in tension, steel yield or buckling in compression, or grout crushing in compression. Any
required increase in strength of the verification test pile elements above the strength required for the production piles shall be provided for in the Contractor’s bid price.

D. Furnish a report consisting of a summary sheet, load settlement graph, micropiles installation data and time load settlement data in addition to items required by ASTM D1143, within seven working days after completion of the test.

E. Do not exceed a vertical settlement tolerance of 1 inch at the vertical design load.

F. If micropile fails, Contractor shall modify the design, the construction procedure, or both. Modifications shall be submitted to the Project Manager for review and approval. All modifications of design or construction procedures shall be at the expense of the Contractor.

END OF SECTION
SECTION 02501

SUPERPAVE ASPHALT MIX, HMA PAVING, AND SURFACING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The Standard and Restricted Performance Specification construction of Plant-Mixed Hot Mixed Asphalt on a prepared surface using a volumetric mixture design developed with the Superpave Gyratory Compactor. The work specified in this Section consists of the paving operations for the areas indicated for new paving.

B. Related Sections:

1. Section 02210 - Grading.
2. Section 02220 - Grading, Excavation, and Backfilling.
3. Section 02222 - Excavation, Backfill, and Compaction for Utilities.

1.02 REFERENCES

A. PENNDOT References: The PENNDOT Sections noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented. The payment provisions do not apply to work to be performed under this Specifications Section.

1. PENNDOT Section 309 Superpave Asphalt Mixture design, Standard Construction, HMA Base Course.
2. PENNDOT Section 350 Subbase.
4. PENNDOT Section 460 Bituminous Tack Coat.
5. PENNDOT Section 461 Bituminous Prime Coat.
6. PENNDOT Section 470 Bituminous Seal Coat.
7. PENNDOT Section 480 Bituminous Surface Treatment.
8. PENNDOT Section 491 Milling of Bituminous Pavement Surface.
9. PENNDOT Section 630 Plain Cement Concrete Curb.
10. PENNDOT Section 676 Cement Concrete Sidewalks.
11. PENNDOT Section 677 Selected Material Surfacing.
12. PENNDOT Section 702 Bituminous Material.
13. PENNDOT Section 703 Aggregates.
14. PENNDOT Section 704 Cement Concrete.
15. PENNDOT Section 705 Joint Material.
16. PENNDOT Section 709 Reinforcement Steel.
17. PENNDOT Section 721 Calcium Chloride.
18. PENNDOT Section 962, Painting Traffic Lines and Markings.

B. ASTM International (ASTM):
   1. ASTM D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft$^3$ (2,700 kN-m/m$^3$)).
   2. ASTM D2167, Standard Test Method for Density of and Unit Weight of Soil in Place by the Rubber Balloon Method.

C. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO T 180, Moisture-Density Relations of Soils Using a 10-lb. Rammer and an 18-inch Drop.

1.03 DEFINITIONS

A. Specified Maximum Trench Width: The applicable maximum trench width specified in Section 02222.

B. Street: Unless otherwise specifically qualified herein, the term Street as used in this Section is understood to mean a street, road, alley, lane, driveway, parking lot, or any other area used as a way for vehicles.
1.04 QUALITY CONTROL

A. Source Quality Control: Maintain the quality of work by using the products of a qualified Superpave Asphalt Mixture Design producer and qualified plant operating workmen.

1. Use products of a Superpave Asphalt Mixture Design bulk producer regularly engaged in production of Superpave Asphalt Mixture Designs conforming to the standards referenced herein.

2. Use materials conforming to the requirements of the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented.

B. Workmen Qualifications: Provide at least one person thoroughly trained and experienced in the skills required and who readily understands the design and is completely familiar with the application of Superpave Asphalt Mix paving work.

1. During progress of Superpave Asphalt Mix paving work, the trained person shall be present to direct the performance of work.

2. For actual finishing of Superpave Asphalt Mix surfaces and operation of the equipment, use only personnel thoroughly trained and experienced in the skills required.

1.05 PROJECT CONDITIONS

A. Environmental Requirements:

1. Dust Control: Provide effective dust control by sprinkling water, by the use of calcium chloride, or by other methods as approved by the SEPTA Project Manager. Use dust control measures where and when, and in a manner as required by the SEPTA Project Manager.

2. Temperature Limitations: Terminate placement of Superpave Asphalt Mix courses of permanent pavement between October 15 and October 31, and do not resume placement prior to April 1 to April 15; interim days between date limits may be used for placement as determined by the SEPTA Project Manager depending upon weather temperature conditions.

a. Do not install aggregate courses when ambient temperature is below or is expected to fall below freezing.

b. Do not use aggregate containing frost nor place aggregate courses on frozen subgrade.
c. Do not place Superpave Asphalt Mix courses of permanent pavement when the ambient temperature is 40 degrees F or lower; nor when the temperature of the pavement, base, or binder on which it is to be placed is 40 degrees F or lower.

3. Paint Application Limitations: Adhere to manufacturer’s data on air and surface temperature limits and relative humidity during application and curing of coatings.
   
a. Do not spray-apply paint when wind velocity is above 15 mph.
   
b. Schedule painting work to avoid dust and airborne contaminants.
   
c. Apply paint during daylight hours only.

B. Restrictions and Limitations Regarding Permanent Pavement Placement:

1. Streets Other Than State Highways: The permanent replacement of street roadway and shoulder pavement shall be placed as soon as the trenches have been acceptably backfilled; however, in the event the permanent pavement cannot be placed due to the weather limitations specified previously, provide a temporary pavement. No separate or additional payment will be allowed the Contractor for furnishing, placing and removing this temporary pavement.

C. Protection: The Contractor shall assume responsibility for any injury or damage resulting from lack of required maintenance or repairs during Guarantee Period. The Contractor shall indemnify and save harmless SEPTA and SEPTA Project Manager from loss by reason of suit or action at law, based upon occurrence or omission occurring during this period.

1. Protect and maintain cut pavement edges until permanent replacement paving is placed.

2. Protect paved surfaces outside of the pavement removal limits. Repair pavement outside removal limits, as may be damaged by construction operations, at no expense to SEPTA.

3. Use such means as necessary to protect and maintain pavement materials before, during, and after installation to protect the installed work and materials of other trades.

4. In the event of failure of the work of this Section within the Guarantee Period, immediately make repairs and replacements. Upon failure to perform maintenance or repairs within three days after receiving written notice from the SEPTA Project Manager, the SEPTA Project Manager may perform such maintenance or repairs and deduct the
cost thereof from any moneys due or to become due the Contractor under the Contract.

5. Paint Products Storage: Take necessary precautions to ensure safe storage and use of paint materials and the prompt and safe disposal of waste. Store paint products protected from weather when these products may be affected by freezing.

D. Completion Certificate will not be issued until work of this Section is completed.

1.06 SUBMITTALS

A. Producer Quality Control Plan.

B. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

C. Job-Mix Formula (Design): Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work. Submittal should also include QC test data results from current batch mix.

D. Paving Operations Quality Control Plan.

E. Samples: For each paving fabric, 12 inches by 12 inches minimum.

F. Qualification Data: For manufacturer.

G. Material Test Reports: For each paving material.

H. Material Certificates: For each paving material, signed by manufacturers.

PART 2 PRODUCTS

2.01 BASE COURSE MATERIALS

A. Subbase: Composed of Coarse Aggregate Type C (or better) stone conforming to PENNDOT Section 703.2, No. 2A aggregate.

B. Superpave Asphalt Mixture Design, 25mm, HMA Base Course: Conforming to PENNDOT Section 309 and Section 409 for RAP requirements.

2.02 SURFACE COURSE MATERIALS

A. Bituminous Materials:

2. Bituminous Tack Coat: Class E-1, E-6, or E-8 emulsified asphalt conforming to PENNDOT Bulletin 25.

3. Bituminous Prime Coat: Conforming to bituminous material requirements of PENNDOT Section 461.2(a).

B. Bituminous Pavement Materials:

1. Wearing Course: Superpave Asphalt Mixture Design, 9.5mm, HMA Wearing Course: Conforming to PENNDOT Section 409.

2. Bituminous Seal Coat: Conforming to PENNDOT Section 470.2.

3. Bituminous Surface Treatment: Conforming to PENNDOT Section 480.2.

2.03 MISCELLANEOUS MATERIALS

A. Temporary Paving: Type 2-P Bituminous Stockpile Patching Material conforming to Section 484 of Bulletin 27.

B. Aggregate Surface: Select Granular Material (2RC) conforming to PENNDOT Section 703.3.

C. Traffic Zone Paint: Provide products meeting requirements of PENNDOT Section 962 for the following:

1. White Traffic Zone Paint: Low-heat, rapid-dry formulation for parking stalls and stop bars; reflective.

2. Yellow Traffic Zone Paint: Low-heat, rapid-dry formulation for lane and directional markings, reflective.

3. Blue Traffic Zone Paint: Low-heat, rapid dry formulation for handicapped parking areas; reflective.

4. Paint Quality: Paint material composition shall conform to AASHTO Type F paint formulation and AASHTO M-247, Type 1 (standard gradation) for reflective media (glass beads).

D. Pavement Sealer Coating: Provide a coal tar compound modified with an anionic latex emulsion and emulsified into a homogenous sealant type coating for complete coverage of paved surfaces.

1. Pavement sealer shall meet or exceed the requirements of Federal Specification RP-355e and MIL-C-15203C.

2. Acceptable Manufacturers:
a. SealMaster, Inc.; SealMaster Coal Tar Sealer with Top Tuff Latex Additive.

b. Or approved equal.

3. Mixing Water: Use potable water free from harmful soluble salts for mixing the sealer slurry. Water temperature at time of mixing shall have a minimum temperature of 50 degrees F.

2.04 PAVEMENT MIXES

A. Composition of Mixtures: Base and wearing course mixture composition shall conform to the requirements of PENNDOT Section 409.

1. Establish a job-mix formula prior to beginning work which; shall not be changed during the progress of work without the SEPTA Project Manager’s approval. Job-mixing tolerances shall not be presumed to permit acceptance of materials whose gradations fall outside the master ranges set in the specified PENNDOT Sections.

2. The approved job-mix formula shall lie within the specification limits and be suitable for the layer thickness and other conditions prevailing. It shall not be changed after work has started without the approval of the SEPTA Project Manager.

PART 3 EXECUTION

3.01 PREPARATION

A. Subgrade Preparation: Just prior to subbase installation, as specified in Section 02210, perform roadway grading and finish rolling.

1. Perform subgrade preparation only after site grading, trenching, etc., have been completed and accepted by the SEPTA Project Manager.

2. The moisture content of the subgrade material at the time of compaction shall not exceed two percentage points above the optimum moisture content.

3. Subgrade Over Trenches: Backfill and compact trenches as specified in Section 02222.

B. Subbase Construction: Install coarse aggregate Subbase in accordance with PENNDOT Section 350. Install Subbase to after compaction thickness indicated on the Drawings.
C. **Base Course Construction:** Install Crushed Aggregate Base Course in accordance with PENNDOT Section 310. Install Base Course to the compacted thickness indicated on the Drawings.

D. **Surface Preparation in On-site Paved Areas:** Prior to constructing stone base, clear the subgrade of foreign substances. Subgrade shall not contain frozen material. Correct ruts, or soft or yielding spots, having inadequate stability in accordance with highway department specifications.

1. Shape and compact subgrade to form the elevation and cross section as indicated. Compact subgrade to not less than 100 percent of the determined dry weight density. Dry weight density per cubic meter [cubic foot] for the material in-place and the in-place density or compaction will be determined in accordance with local highway department testing methods.

2. The moisture content of the subgrade material at the time of compaction shall be not more than two percentage points above the optimum moisture content.

**3.02 TEMPORARY PAVEMENT INSTALLATION**

A. **Streets Other Than State Highways:** When permanent pavement cannot be placed because of previously specified weather limitations on placing Superpave Asphalt Mix pavement courses, provide temporary pavement over areas where existing pavement has been removed. Install temporary pavement to 2 inches thickness after compaction, with top surface flush with surface of adjacent pavement.

**3.03 PERMANENT REPLACEMENT PAVING INSTALLATION**

A. **General Requirements:** Methods of preparing paving mixture, placing paving mixture, compaction, and protection of in-place bituminous concrete pavement shall comply with PENNDOT Sections 309 and 409. The specified thicknesses are the compacted thicknesses.

1. **Thicknesses of replacement pavement is as follows.**

   a. **Bituminous Paving**

   Superpave Asphalt Mixture Design, 9.5mm, HMA Wearing Course, .3 to 3 million ESALS, 38mm [1 ½"] depth, SRL-M.

   Superpave Asphalt Mixture Design, 25mm, HMA Base Course, .3 to 3 million ESALS, 102mm [4"] depth.

   203mm [8"] 2A Aggregate
2. Install surface course of replacement pavement with top surface flush with surface of adjacent pavement.

3. Install permanent replacement paving over areas where the paving has been removed.

4. Prior to replacing pavement on areas that have been milled, condition the existing pavement in accordance with PENNDOT Section 401.3 (f).

B. Base Course Installation:

1. Superpave Asphalt Mixture Design, 25mm, HMA Base Course: Construct in accordance with the requirements of PENNDOT Section 309.
   a. Where roadways receive trench restoration only, install the Bituminous Concrete Base Course with the top surface below the surface of the adjacent pavement a distance equal to the thickness of the replacement surface course pavement.
   b. Where roadways receive overlay pavement, install the Bituminous Concrete Base Course with the top surface flush with the surface of the adjacent pavement.

2. Aggregate-Bituminous Base Course: Construct in accordance with PENNDOT Section 320.

C. Wearing Course Installation:

1. Superpave Asphalt Mixture Design, 9.5mm, HMA Wearing Course. Construct in accordance with the requirements of PENNDOT Section 409.
   a. Use Bituminous Tack Coat material to seal joints in wearing courses as specified in PENNDOT Section 401.3 (j) 3.

2. Bituminous Surface Treatment: Construct in accordance with the requirements of PENNDOT Section 480.

3.04 MISCELLANEOUS MATERIALS INSTALLATION

A. Pavement Sealer Application: Prior to sealer application, perform such pavement surface preparation as recommended by the sealer manufacturer.

   1. New pavement installations shall cure a minimum of four weeks before sealer applications.
2. In existing pavement make repairs to hairline cracks, and cracks up to 1/8-inch, by cleaning and filling with SealMaster Pourable Crack Filler. Clean and fill cracks 1/2-inch and over with SealMaster Trowel Grade Crack Filler or Crack-Master 3405 hot pour crack filler.

3. Proportion and mix the pavement sealer in strict accordance with the manufacturer's instructions.

4. Apply the pavement sealer in a two-coat application at the rate of .12 gallons per square yard.

3.05 PAVEMENT INSTALLATION

A. General Requirements: Methods of preparing paving mixture, placing paving mixture, compaction, and protection of in-place bituminous concrete pavement shall comply with PENNDOT Sections 309 and 409. The specified thicknesses are the compacted thicknesses.

1. Thicknesses of pavement is as follows.

   a. **Type ‘A’ Bituminous Paving**
      Superpave Asphalt Mixture Design, 9.5mm, HMA Wearing Course, .3 to 3 million ESALS, 38mm [1 ½"] depth, SRL-H.
      Superpave Asphalt Mixture Design, 25mm, HMA Base Course, .3 to 3 million ESALS, 115mm [4 1/2"] depth.
      203mm [8"] 2A Aggregate

   b. **Type ‘B’ Bituminous Paving**
      Superpave Asphalt Mixture Design, 9.5mm, HMA Wearing Course, .3 to 3 million ESALS, 38mm [1 ½"] depth, SRL-L.
      Superpave Asphalt Mixture Design, 25mm, HMA Base Course, .3 to 3 million ESALS, 102mm [4"] depth.
      152mm [6"] 2A Aggregate

B. On-site Pavement Base and Surface Course Installation: Place base course from four to six inches thickness uniformly over prepared surface using only mechanical aggregate spreaders for such work, except where areas are too small to accommodate such equipment. Do not place base course on frozen subgrade.

1. Prior to pavement installation ensure all edges of existing pavement adjoining areas of new bituminous paving have been saw-cut with a vertical edge to allow proper compaction of pavement sub-base and pavement courses.

2. Compact base course by rolling with equipment meeting State Highway Department qualifications and local limits. Maintain the water content of the material at the optimum percentage plus or
minus 1½ percent (as determined by ASTM D1557) during placing and compaction. Continue rolling operation until base is compacted to not less than 100 percent of the maximum laboratory density as determined by ASTM D1557, Method D (AASHTO T 180). Measure in-place density of base course by ASTM D2167 or other method as approved by the SEPTA Project Manager.

3. No deviation in excess of ½-inch (when tested with a ten foot straight edge) will be allowed in the completed surface of the completed base. Completed thickness of the base shall be within plus ¾-inch or minus ½-inch of the thickness indicated, with the average thickness being not less than design thickness. Maintain finished base in a condition that will meet project specification requirements until work is accepted.

4. Place Superpave Asphalt Mixture Design, HMA Wearing Course materials by mechanical spreading and finishing equipment meeting requirements of the State Highway Department specifications. On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing impracticable, the mixture shall be placed and screeded by hand tools to give the required compacted depth. Methods of spreading and finishing Superpave Asphalt Mixture Design, HMA Base Course shall also meet requirements of local highway department specifications.

5. Immediately after spreading Superpave Asphalt Mixes, and after surface irregularities are adjusted, thoroughly and uniformly compact by rolling. Roll the surface when the mixture is in the proper condition and when the rolling does not cause undue displacement, cracking, or shoving.

6. The number, weight, and type of rollers furnished shall be sufficient to obtain the required compaction while the mixture is in a workable condition. The sequence of rolling operations, the selection of roller types, and the number of passes shall produce a density equal to 95 percent of the corresponding daily plant Marshall density. Continue finish rolling until all roller marks are eliminated. Equipment and specific rolling procedures shall be in accordance with the State Highway Department specifications.

7. The finished surface shall be smooth and, when checked with a ten foot straight-edge, no part of the surface shall deviate more than ¼-inch.
3.06 PAVEMENT MARKING

A. Paint Application: Strictly follow paint manufacturer's label instructions for mixing, thinning, proper spreading rate and drying time. In no case shall film thickness be less than manufacturer's recommendations nor shall area coverage per gallon exceed manufacturer's recommendations.

1. Preparation: Prior to pavement marking, clean pavement surface free of contaminants that will prohibit paint adhesion.

2. Thinning: If material has thickened or must be diluted for application, the coating shall be built up to the same film thickness achieved with undiluted material. Do not use thinner to extend coverage of the paint.

3. Coverage Rate: Regardless of the surface condition, apply paint to achieve a suitable finish either by decreasing the coverage rate or by applying additional coats of paint.

4. Provide temporary satisfactory barriers for at least 30 minutes, or until the paint is dry and track free from vehicular traffic. Repaint marked or damaged areas.

B. Roadway Traffic Lines and Markings: Apply in accordance with PENNDOT Section 962 and the following additional requirements:

1. Apply wet paint lines as indicated with an allowable width tolerance of plus or minus 1/8-inch.

2. Spot the location of the final pavement markings by applying pavement spots at 25 foot intervals. Have the SEPTA Project Manager approve the final location of the spots before applying the traffic lines.

3. Paint lines accurately with sharp, clearly defined edges. Paint solid colored areas free of skips and holidays. Make linework straight and uniformly spaced.

4. Provide temporary satisfactory barriers for at least 30 minutes, or until the paint is dry and track free from vehicular traffic. Repaint marked or damaged areas.

C. Parking Area Traffic Lines and Markings: Striping shall consist of 4 inch wide painted lines of length and spacing indicated on the Drawings. Paint lines accurately with sharp, clearly defined edges. Paint solid colored areas free of skips and holidays. Make linework straight and uniformly spaced.
1. Parking stall striping colors to be as follows:
   a. SEPTA Parking Spaces: Yellow.
   c. Accessible Spaces: Blue.

3.07 MAINTENANCE

A. Continuously maintain temporary pavement without additional compensation until it is replaced with permanent pavement.

B. Without an increase in Contract Price, maintain the work done under this Section for a period as stated in the Agreement after the date of SEPTA’s approval of the Substantial Completion Certificate issued by the SEPTA Project Manager. Maintenance shall include the repair or removal and replacement of such work, which has failed, or wherever surface depressions have developed. Materials and methods used to repair or replace such work shall conform to the applicable requirements of this Section.

C. Should the Contractor fail to perform required maintenance or repairs within three days after receiving written notice from the SEPTA Project Manager, the SEPTA Project Manager may perform such maintenance or repairs and deduct the cost thereof from monies due or to become due the Contractor.

END OF SECTION
SECTION 02525
OVERLAY PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of the overlay paving operations for State Highways, Streets Other Than State Highways and other bituminous areas.

B. Related Sections:
   1. Section 02222 – Excavation, Backfill, and Compaction for Utilities.
   2. Section 02501 – Superpave Asphalt Mix HMA Paving and Surfacing.

1.02 REFERENCES

A. The PENNDOT Sections noted herein refer to sections contained in the Commonwealth of Pennsylvania Department of Transportation Specifications Publication 408, as supplemented. The payment provisions do not apply to work to be performed under the Contract.
   1. PENNDOT Section 309 Superpave Asphalt Mixture design, Standard Construction, HMA Base Course.
   2. PENNDOT Section 409 Superpave Asphalt Mixture Design, Standard and RPS Construction of Plant-Mixed HMA courses.
   3. PENNDOT Section 460 Bituminous Tack Coat.
   4. PENNDOT Section 461 Bituminous Prime Coat.
   5. PENNDOT Section 470 Bituminous Seal Coat.
   6. PENNDOT Section 480 Bituminous Surface Treatment.
   7. PENNDOT Section 501 Reinforced or Plain Cement Concrete Pavements.
   8. PENNDOT Section 692 Traffic Lines and Markings.

B. Commonwealth of Pennsylvania Department of Transportation (PENNDOT) Bulletin 25.
1.03 DEFINITIONS

A. Specified Maximum Trench Width: The applicable maximum trench width specified in Table B in Section 02222.

B. Street: Unless otherwise specifically qualified herein, the term street as used in this Section is understood to mean a street, highway, avenue, boulevard, road, alley, lane, driveway, parking lot, or any other area used as a way for vehicles.

1.04 QUALITY ASSURANCE

A. Source Quality Control: As specified in Section 02501.

B. Workmen Qualifications: As specified in Section 02501.

C. Requirements of Regulatory Agencies: As specified in Section 02501 with the following additional requirement.

1. Unless otherwise specified or required by the SEPTA Project Manager, overlay paving work will not be permitted until all other preparation has been completed.

1.05 PROJECT CONDITIONS

A. Environmental Requirements: As specified in Section 02501.

B. Time Requirements: As specified in Section 02501.

PART 2 PRODUCTS

2.01 SURFACE COURSE MATERIALS

A. Bituminous Materials:


2. Bituminous Tack Coat: Class E-1, E-6, or E-8 emulsified asphalt conforming to PENNDOT Bulletin 25.

3. Bituminous Prime Coat: Conforming to bituminous material requirements of PENNDOT Section 461.2(a).

B. Bituminous Pavement Materials:

1. Wearing Course: Superpave Asphalt Mixture Design, 9.5mm HMA Wearing Course: Conforming to PENNDOT Section 409.

2. Bituminous Seal Coat: Conforming to PENNDOT Section 470.2.
3. Bituminous Surface Treatment: Conforming to PENNDOT Section 480.2.

2.02 PAVEMENT MIXES

A. Composition of Mixtures: Binder and wearing course mixture composition shall conform to the requirements of PENNDOT Section 401.

1. Establish a job-mix formula prior to beginning work which shall not be changed during the progress of work without the SEPTA Project Manager’s approval. Job-mixing tolerances shall not be presumed to permit acceptance of materials whose gradations fall outside the master ranges set in the specified PENNDOT Sections.

2. The approved job-mix formula shall be within the specification limits and be suitable for the layer thickness and other conditions prevailing. Do not change the formula after work has started without the approval of the SEPTA Project manager.

B. Surface Treatment Design: Submit to the SEPTA Project Manager for review according to requirements of PENNDOT Section 480.

PART 3 EXECUTION

3.01 PREPARATION

A. Surface Preparation of Existing Paving:

1. Prior to overlay paving, condition the existing paving in accordance with PENNDOT Section 401.3(f).

2. Prior to surface treatment application, condition the existing paving in accordance with PENNDOT Section 480.

B. Patching/ Scratch Course for Existing Paving:

1. Prior to overlay paving, patch potholes and other damaged areas in the existing paving. The location and extent of the pavement patching will be determined by the SEPTA Project Manager.

2. Scratch Course: Place scratch course separately, ahead of resurfacing operations. Use the scratch course to fill wheel ruts and other local, small depressions to the level of the surrounding pavement. Location and extent of leveling will be determined by the SEPTA Project Manager.

3. Thoroughly clean and remove loose material, dry and prime with a light coat of emulsified asphalt areas to be patched or leveled.
4. Use Superpave Asphalt Mixture Design HMA Wearing Course material placed by hand, spread with rakes, lutes, brooms or shovels to obtain uniform placement. Use hand operated vibratory compactor or similar equipment for compaction. When approved by SEPTA Project Manager, mechanical pavers or conventional power rollers may be used in areas requiring leveling.

5. When patch exceeds one-inch in depth, cut the edges of pavement square and vertical to provide mechanical shoulder.

C. Adjustment of Height of Gas and Water Service Boxes and Frames of Underground Structures:

1. Adjust the heights of gas and water service boxes and frames of other underground utility structures if they are existing within the street or paved area receiving overlay paving. Adjust these boxes and frames to the new finish grade elevations of the overlay paving.

2. Make the necessary arrangements with the respective utility companies for adjustment of their service boxes and frames of underground structures.

3. Do not proceed with the overlay paving until the heights of service boxes and frames of underground structures have been adjusted to the satisfaction of the SEPTA Project Manager.

4. No separate or additional payment will be made for adjusting the heights of service boxes, and frames of other underground structures, it being understood and agreed that such costs are included in the Contract price for furnishing and placing the overlay paving.

D. Painting Vertical Surfaces: Prior to placing the overlay pavement, paint the faces of vertical surfaces below the reveal with a thin application of asphalt cement to provide a closely bonded, watertight joint.

E. Tack Coat: Prior to placing the bituminous overlay pavement, apply a Bituminous Tack Coat consisting of a thin application of emulsified asphalt to the existing paved surface at such rate and in such manner as set forth in PENNDOT Section 460. Prior to applying the tack coat, clean loose and foreign material from existing pavement surface.

F. Make joints of overlay pavement as specified in PENNDOT Section 401.3 (j).

G. At joints between existing pavement and new paving work, cut the edges of existing pavements neatly trimmed as approved by the SEPTA Project Manager.
Manager. Cut paving with a mechanical saw. Apply asphalt cement at locations where new bituminous paving joins existing bituminous paving.

**3.02 INSTALLATION**

A. General Requirements: Method of placing, compacting and the protection of in-place bituminous for pavement shall comply with PENNDOT Section 401.3.

1. Method of placing, compacting and the protection of in-place bituminous surface treatment shall comply with PENNDOT Section 480.

B. Limits of Overlay Paving: Provide overlay pavement to the limits specified herein and to such additional limits as required by the Pennsylvania Department of Transportation, other agencies having jurisdiction, or the SEPTA Project Manager.

1. State Highways:

   a. Extend overlay paving 25 feet beyond pavement cut back edge at terminal manholes or transverse trenches. Provide overlay paving for the full roadway width or one-half roadway width.

   b. At locations determined by the SEPTA Project Manager, when the distance between transverse crossings of the roadway is less than 100 feet, provide full width overlay to a point 25 feet beyond the cut back edge of the transverse trench.

2. Roadways Other Than State Highways:

   a. Provide overlay pavement for existing access roads, service roads, and parking areas on site as indicated on the Drawings.

C. Overlay Paving, Superpave Asphalt Mixture Design, 9.5mm, HMA Wearing Course.

1. Use materials, composition of mixture and methods to construct the bituminous overlay paving conforming to the applicable requirements of PENNDOT Section 309.

2. **Minimum** thickness of overlay pavement after compaction is to be one inch (1”). The contours of the surface of overlay pavement may be the same as the existing pavement.

3. Install a leveling course of bituminous material in depressions as required and as specified herein.
a. Include the cost of this extra thickness in the cost of overlay paving. No separate or additional payment will be made for installing leveling course.

D. Overlay Paving, Bituminous Surface Treatment: Use materials and methods to construct the bituminous surface treatment conforming to the applicable requirements of PENNDOT Section 409.

E. Shoulders: Reconstruct existing shoulders adjoining overlayed State Highways to provide support for the new overlay pavement.
   1. Reconstruct shoulders of the type specified in and according to requirements of Section 02501.

3.03 MAINTENANCE

A. As specified in Section 02501 with the exception of maintaining temporary paving.

B. Should the Contractor fail to perform required maintenance or repairs within three days after receiving written notice from the SEPTA Project Manager, the SEPTA Project Manager may perform such maintenance or repairs and deduct the cost thereof from any monies due or to become due the Contractor.

END OF SECTION
SECTION 02533
PLAIN CEMENT CONCRETE SIDEWALK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for furnishing and installing plain cement concrete sidewalks and associated surfacing.

B. Related Sections:

2. Section 02220 – Grading, Excavation, and Backfill.
3. Section 03300 – Cast-in-Place Concrete.
4. Section 03400 – Precast Concrete.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

3. AASHTO M 182, Standard Specification for Burlap Cloth Made from Jute or Kenaf.

B. ASTM International (ASTM):

1. ASTM C33, Standard Specification for Concrete Aggregates.


1.03 SUBMITTALS

A. Submit the following information to the SEPTA Project Manager for approval:

1. Shop Drawings:
   a. Working Drawings for the layout of expansion joints.
   b. Working Drawings for the layout of construction joints.

2. Samples:
   a. Subbase aggregate

3. Quality Assurance/Control Submittals:
   a. Design Data:
      1) Concrete mix designs
   b. Certificates:
      1) Certificates of Compliance
         a) Concrete.
         b) Air-entraining admixture.
         c) Concrete curing compounds.
         d) Concrete curing and protecting covers.
         e) Expansion joint fillers.
         f) Stone aggregate.

1.04 QUALITY ASSURANCE

A. Qualifications:
1. Quality Assurance Testing and Inspection Agency Qualifications:
   a. Employ an independent quality assurance testing and inspection agency qualified to perform the inspections and testing required by this Section.

      1) Materials and fabrication procedures are subject to inspection and testing at the source and the field by the independent quality assurance testing and inspection agency.

      2) Inspections and tests performed by the quality assurance testing and inspection agency do not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements listed in Section 01410.

   b. The independent quality assurance testing and inspection agency must conform to the quality standards of the nationally recognized associations and agencies that promulgate the test standards, particularly ASTM E329.

B. Certifications:

   1. Submit certified copies of test reports from the independent quality assurance testing and inspection agency for all analyses and tests required by the referenced AASHTO and ASTM Standards.

      a. Direct the independent quality assurance testing and inspection agency to submit certified written reports that document the results of all tests and inspections performed directly to the SEPTA Project Manager immediately after the work is performed.

         1) In the reports, state whether the tested and inspected items comply with specified requirements or deviate from them.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete:

   1. Portland Cement: Normal strength, Type 1A air entrained, conforming to ASTM C150.
a. Cement concrete shall be a minimum of six and maximum of eight 96-pound bags per cubic yard.

b. Fine aggregate shall be Type A. Do not use fine aggregate produced from limestone in concrete wearing surfaces.

c. Coarse aggregate shall be Type A, No. 57 as specified in PENNDOT Publication 408, Section 703.2 Tables B, C, and D.

B. Normal weight aggregates: ASTM C33.

C. Potable water.

D. Concrete shall have an entrained air content of 6% in the plastic state with a tolerance of +/- 1.5% during the work. Entrained air in the hardened concrete shall not be less than 3.5% or greater than 7.5%. Testing for air entrainment shall be in accordance with PENNDOT Publication 408.

E. Concrete Forms:
   1. Furnish acceptable wood or metal forms that meet the requirements and that extend the full depth of the concrete.
   2. Erect forms true to line and grade. Maintain alignment using steel stakes at intervals not greater than 4 feet.

F. Expansion Joint Fillers:

G. Stone Aggregate:
   1. Crushed Stone: PENNDOT No. 2A coarse aggregate; natural stone, free of shale, clay, friable material, sand, and debris; graded in accordance with ASTM C136.

2.02 MIXES

A. Provide Class A Concrete to the following criteria and in accordance with Section 03300.
   1. Compressive strength at 28 days: 3300 psi.
   2. Slump: 3 inches.
   3. Aggregate size: 1 inch.
2.03 SIDEWALK SURFACES

A. Detectable Warning Surface

1. Provide detectable warning surfaces which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title 49 CFR Transportation, Part 37.9 Standards for Accessible Transportation Facilities, Appendix A, Section 4.29.2 Detectable Warnings on Walking Surfaces.)

2. The detectable warning surface shall contrast visually with adjoining surfaces. The material used to provide contrast shall be an integral part of the walking surface.

3. Detectable warning surfaces shall have a non-slip texture between the truncated domes as well as the surface of the domes. The coefficient of friction rating for the slip resistant texture finish should be not less than 0.60.

4. Materials and installations shall be suitable for exterior applications and shall have the ability to withstand snow removal, deicing chemicals, and freeze thaw conditions.

5. Color of the detectable warning surface to be YELLOW.

B. Applied Rubberized Tactile Surface: in accordance with SEPTA requirements.

1. Acceptable Manufacturers:

   a. Trelleborg.

   b. Or equal.

2.04 SOURCE QUALITY CONTROL

A. Submit Certificates of Compliance from the quality assurance testing and inspection agency certifying that the materials provided comply with the specified requirements.

B. Have the quality assurance testing and inspection agency perform acceptance testing of the stone aggregate at the source.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that previously installed protection measures are in place.
B. Verify that all surfaces abutting new concrete pavement are clean, true, and free from chips, etc.

C. Beginning installation means acceptance of existing conditions.

3.02 PREPARATION

A. Do not place crushed stone on soft, muddy, or frozen areas. Correct irregularities or soft areas before placing crushed stone.

B. Place and secure forms to correct location, dimension, and profile.

C. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

D. Proof roll prepared subbase to check for unstable areas and need for additional compaction.

E. Moisten base to minimize absorption of water from fresh concrete.

3.03 INSTALLATION OF AGGREGATE BASE

A. Maintain optimum moisture content of materials in order to attain required compaction density.

B. Spread crushed stone on prepared subgrade, in a manner not causing segregation, in locations and to attain depth shown on Drawings, after final compaction. Use acceptable equipment and methods per PENNDOT Publication 408.

1. Compact uniformly spread crushed stone to not less than 100% of the maximum dry-weight density, which will be determined in accordance with PTM No. 106, Method B.

2. Proceed with compaction gradually from sides to center, with each succeeding pass uniformly overlapping the previous pass. Continue until the entire area is shaped and compacted.

3. If crushed stone does not contain sufficient moisture after placement, add water to obtain proper compaction.

C. Top surface of compacted crushed stone shall be plus or minus ¼ inch from required depth.

3.04 INSTALLATION OF CONCRETE

A. Comply with ACI recommendations when placing concrete.

B. Mix and deliver concrete in accordance with ASTM C94.
1. Use accelerating admixtures in cold weather only when approved by SEPTA. Use of admixtures will not relax cold weather placement requirements.

2. Use set-retarding admixtures during hot weather only when approved by SEPTA.

C. Place expansion joint filler between new and existing work and as shown on drawings and secure to formwork during concrete placement.
   1. Provide joint filler abutting existing concrete, concrete curbs, catch basins, inlets, manholes, and any other fixed objects.
   2. Recess joint filler ¼ inch from top of slab.

D. Construct control and construction joints in locations indicated on the Drawings.
   1. Form control joints in fresh concrete by grooving top portion with cutting tool and finishing edges with a metal edger having a ¼-inch radius.
      a. Control joints shall have a depth of at least ¼ of the concrete thickness.
      b. Space control joints at the width of the sidewalk, 6' maximum.
   2. Place construction joints at the end of placements and at locations where placement operations are stopped for more than ½ hour except where placements stop at expansion joints.
      a. Place expansion joints at 30' maximum spacing.
      b. Construct joints using standard metal keyway section forms.
   3. The concrete around light standards, poles, fire hydrants, access frames, and covers to underground utilities, manhole frames and covers, and similar structures shall be scored, by edging or grooving, in a block 8 inches wider than the maximum dimensions of the structure.

E. Maintain records of concrete placement. Record date, location of pour, quantity, air temperature, and test samples taken.

F. Provide concrete pavement with a light broom finish.
G. The edges and perimeter and expansion and control joint scoring of all slabs shall be edged with a metal edger having a ¼-inch radius to produce a dense compact border outlining each slab.

3.05 CONCRETE CURING

A. Immediately after placement, protect concrete from premature drying, excessive hot or cold temperatures, and mechanical injury.
   1. Maintain concrete with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of cement and hardening of concrete.
   2. When the average daily temperature is less than 40 degrees F, maintain temperature of newly placed concrete between 50 to 70 degrees F during the required curing period.
   3. When the average daily temperature is above 70 degrees F, protect the newly placed concrete from high temperatures and drying winds by keeping the concrete surface continually wet and by providing wind breaks during the required curing period.
   4. Provide 30 days curing period before applying Special Coating.

3.06 INSTALLATION OF SIDEWALK SURFACES


B. Applied Rubberized Tactile Surface: Install where indicated on the Drawings in accordance with manufacturers recommendations and SEPTA requirements.

3.07 PROTECTION

A. Protect the walks from damage until acceptance of the work.
   1. Exclude pedestrians from walks for at least 3 days after placement.
   2. Provide necessary watchmen to prevent vandalism to freshly poured concrete walks.

3.08 FIELD QUALITY CONTROL

A. Submit samples of the subbase aggregate obtained from the construction site to the quality assurance testing and inspection agency for verification testing.
3.09 CLEANING

A. Sweep the concrete walks.

B. Wash the concrete walks so they are free of stains, graffiti, discoloration, dirt, and other foreign materials.
   1. Completely remove graffiti from graffiti-marked sidewalks.

C. Satisfactorily dispose of unsuitable and surplus materials provided under this Contract.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work is the design and preparation of drawings for the construction of curb ramps as required to provide pedestrian access in accordance with the policy and design criteria in PennDOT Publication 13, Design Manual Part 2, Chapter 6 and PennDOT Publication 72M, Roadway Construction Standards RC-67M.

1.02 RELATED SECTIONS

A. Division 1 – General Requirements

1.03 REFERENCES

A. PennDOT Publication 13, Design Manual Part 2

B. PennDOT Publication 72M, Roadway Construction Standards RC-67M.

PART 2 EXECUTION

2.01 PREPARATION

A. General

1. The contract documents identify the locations where pedestrian curb ramps are proposed in order to meet vehicular and pedestrian safety parameters.

2. Detectable Warning Surfaces must be provided at the junction between the Pedestrian Access Route (PAR) and commercial driveways provided with traffic control devices or driveways that are otherwise allowed to operate like public streets.

3. Provide design and drawings in English units.

4. Provide a Design Activity Schedule.

B. Additional Designer Qualifications

1. For this Design Activity, résumés must demonstrate experience and expertise, during the last 5 years, with Americans with Disabilities
Act (ADA) requirements as contained in Code of Federal Regulations; 28 CFR Part 36 and other applicable design criteria, standards, guidelines and construction specifications.

C. Design Specifications

1. Provide a Design Drawing as specified in PennDOT Publication 408 Section 105.02(c) and in accordance with Part G Design Requirements of this Special Provision.

2. Designs copied directly from PennDOT Standard Drawings need not be documented through independent computations. List such designs on the submission by referencing the drawing number of the applicable standard, and the sheet number, table, or graph. Experimental or demonstration-type design concepts, products, structures, or elements not pre-approved by the PennDOT for general usage at the time of bid, will not be allowed. Designs that take advantage of any errors and/or omissions in the following requirements will not be accepted. In the event any such error, omission, or discrepancy is discovered, immediately notify the Project Manager. Failure to notify the Project Manager will constitute a waiver of all claims for misunderstanding, ambiguities, or other situations resulting from the error, omission, or discrepancy.

3. Final Plans must include a note on all tabulation of quantities sheets included therein that states “Item numbers and descriptions listed in Tabulations are solely for the purposes of identifying the specified units of work and locations, and are not to be construed as contract or pay items.”

4. Perform the design activities in accordance with the latest published edition of all PennDOT Standards, Specifications, Regulations, Strike-off Letters, and other industry standards, at the time of advertisement, unless directed otherwise, or as identified in the bid package. These include, but are not limited to the following:

   a. Special Provisions;
   b. Publication 408, *Specifications*
   c. Publication 72M, *Standards for Roadway Construction*
   d. Publication 13M Design Manual Part 2 – *Highway Design*
   e. Publication 14M Design Manual Part 3 – *Plans Presentation*
g. Publication 149, *Traffic Signal Design Handbook*

h. Publication 35, *Approved Construction Materials*

i. Publication 203, *Work Zone Traffic Control*

j. Publication 213, *Temporary Traffic Control Guidelines*


l. Pa Code Title 67, Chapter 212, *Official Traffic Control Devices* (Publication 212)

m. Publication 236M, *Handbook of Approved Signs*

n. Publication 111M, *Traffic Control – Pavement Markings and Signing Standards*

o. Publication 148, *Traffic Standards – Signals*

p. Publication 7, *Items Catalog*

q. *Manual on Uniform Traffic Control Devices* (FHWA)

r. *A Policy on Geometric Design of Highway and Streets,* AASHTO "Green Book"

s. *A Policy on Design Standards – Interstate System* (AASHTO)

5. In the event that a clear order of predominance cannot be established, or a difference in interpretation of the design cannot be resolved, the PennDOT Assistant District Executive-Design will be the arbiter and his/her decision will be final.

6. The proposed curb ramp drawings do not require a signature or seal of a Professional Engineer registered in the Commonwealth of Pennsylvania.

D. Utilities

1. If utility relocations are part of the construction effort, notify the affected utility companies of the project construction effort in advance, secure the utility company approvals and incorporate their scheduling requirements in to the overall project schedule.
E. Signalized Intersections

1. Ensure that pedestrian visibility is not compromised by the new curb ramp locations. Ensure that distances to the signal head from the stop bar are within the guidelines established in PennDOT Publication 149 – Traffic Signal Designer Handbook. Ensure signal heads are visible from new ramp locations and stop bars are within the guidelines established in Publication 149 Traffic Signal Designer Handbook. PennDOT approval for signal and signal hardware location adjustment is required.

2. For new signal equipment installations, coordinate the location and design of the new curb ramps with the Traffic Signal Plans and the traffic signal equipment spot locations as determined in the field. Signal equipment locations may need adjustment for accommodation of curb ramps.

F. Public Right of Way

1. If curb ramps are located outside Public Right of Way, refer to PennDOT Design Manual 2 Chapter 6 Section 6.4 (B).

G. Design Requirements


2. Design alterations to existing facilities to meet the requirements to the maximum extent feasible. For alterations where it is technically infeasible to meet these requirements, submit a Technically Infeasible Form (TIF) and obtain approval to document access has been provided to the maximum extent feasible.

3. Provide positive drainage and avoid potential drainage issues for each ramp. No pooling or ponding of water is permitted. A pavement adjustment may be required to correct issues related to the ponding or pooling of water in front of the curb ramp. Ensure that any pavement adjustment provides positive drainage and maintains the existing direction of the flow of water. Do not allow water to flow into the travel lane where it does not currently.

4. Provide access to existing push buttons to the maximum extent feasible. Provide 4 foot x 4 foot minimum area with 2.00% maximum longitudinal and cross slope, or to the maximum extent feasible, at existing and proposed push button locations where
pedestrians perform a 180 degree turning maneuver to access and the ramp.

5. Designs utilizing cheek-walls and vertical drops will require Department approval. Designs must include pedestrian barriers, for approval by the Department, if vertical drops are used. Otherwise, grade non-walk areas in accordance with PennDOT Standard Drawing RC-67M.

6. All minimum and maximum dimensions contained on the PennDOT Standard Drawings RC-67M are absolute. Construction tolerances do not apply when a dimension is shown as minimum or maximum.

H. Submittals

1. Submit hard-copy packets containing all drawings, forms, and related documents of each intersection for approval by PennDOT. In addition to hard-copy packets, submit electronic copies of all drawings, forms and related documents on a CD. These design packets are to conform to the following specifications and contain following information:

a. Complete PennDOT CS-4401 Design District 6 Form. Submit all hard copies in color.

b. Provide design drawings drawn to scale at a minimum of 1 inch = 10 feet on 11” x 17” sheets of paper, each depicting an entire intersection with all appurtenant ramps and enough detail to illustrate any impediments to providing any ramps which are not fully in accordance with PennDOT Standard Drawing RC-67M.

c. Indicate a NORTH arrow on the drawing identifying the direction of magnetic North.

d. Include a title block in the lower right hand corner containing the project name and ADA Log No., date of submittal, a block for date of resubmittal(s), the name of the designer and firm along with the appropriate sheet number(s).

e. Depict and label the type of curb ramp proposed.

f. Depict and label the proposed length and width of the curb ramp (designated to the nearest 0.10 foot).

g. Depict and label the proposed running and cross slope percent of the ramp (designated to the nearest 0.10%).
h. Dimension the length of depressed curb on skewed or radial ramps.

i. Indicate the proposed horizontal placement of Detectable Warning Surface (DWS).

j. Depict and label the longitudinal slope along the Detectable Warning Surface (DWS) or transition strip (designated to the nearest 0.10%).

k. If large triangular areas are proposed, Depict and label the lateral slope of the flare between the sidewalk and the bottom of the DWS, if applicable (designated to the nearest 0.10%).

l. Depict and label proposed slopes of flares (designated to the nearest 0.10%).

m. Depict and label proposed horizontal measurement(s) of flares (designated to the nearest 0.10 foot).

n. Depict and label proposed horizontal location and horizontal measurements of the landing area (designated to the nearest 0.10 foot).

o. Depict and label proposed slopes of the landing area (designated to the nearest 0.10%).

p. Depict and label the proposed running & cross slope percent of the sidewalk transitions to the ramp and/or landing (designated to the nearest 0.10%).

q. Depict and label running and cross slope of the existing sidewalk adjacent to the sidewalk transitions (designated to the nearest 0.10%).

r. Depict and label the proposed vertical elevations of the curb ramp, landing area and sidewalk transition area (designated to the nearest 0.01 foot).

s. Depict and label the proposed curb reveal at the curb ramp, flares and/or sidewalk transition area (designated to the nearest 0.10 foot).

t. Depict and label the existing curb reveal adjacent to the curb ramp, flares or sidewalk transition area (designated to the nearest 0.10 foot).
u. Indicate limits of removal of existing sidewalk, curb, and curb ramp(s) (designated to the nearest 0.10 foot). Terminate limits of work at existing tooled expansion/contraction joints. Curbs may be saw cut.

v. Depict and label all proposed cheek walls or proposed grading require tie into the existing grade. Label the proposed reveal of the cheek wall (designated to the nearest 0.10 foot) and the slope of the proposed grade (designated to the nearest 0.10%)

w. Depict and label the existing and proposed longitudinal and cross slopes of the roadway directly in front of and at the center of the proposed ramp (designated to the nearest 0.10%).

x. Depict and label the existing and proposed vertical elevations of the finished grade of roadway directly at the corners of the proposed ramp and transition ends ramp (designated to the nearest 0.01 foot).

y. Depict and label the existing and proposed gutter slopes along the entire area of curb replacement and the curb reveals at the flare and tie-in locations (designated to the nearest 0.10%).

z. Indicate the limits and slopes of proposed pavement adjustments required to correct issues related to the ponding or pooling of water in front of the curb ramp (designated to the nearest 0.10%).

aa. Depict and label the existing and/or proposed slopes in the roadway along the gutterline to the left and right of the proposed ramp within the reconstruction area (designated to the nearest 0.10%).

bb. Depict and label the proposed-existing crosswalk line striping on the plans, the width of the crosswalk and the horizontal relationship of the crosswalk and stop bars (designated to the nearest 0.10 foot).

cc. Depict any utility features within the curb ramp construction area.

dd. Show proposed relocation, reset and replacement of existing conflicting utilities, roadside appurtenances and underground facilities. Provide approval, in writing, from affected utility,
roadside appurtenance owner or agency, including their requirements.

ee. Depict and label the vertical elevation at all four corners of existing and proposed traffic signal foundations (designated to the nearest 0.01 foot).

ff. Depict horizontal and vertical relationships to the pedestrian push buttons (designated to the nearest 0.10 foot).

gg. Indicate existing and proposed right-of-way and construction easements (including the administrator of the right-of-way, e.g. state, municipal, or dedicated etc.).

hh. Indicate location changes of proposed traffic signal hardware. Show contract drawing location and contemplated location.

ii. At signalized intersections, provide vehicular clearance interval calculations and pedestrian clearance calculations based on ramp locations. Utilize 3.5 feet/Second for walking speed and curb-to-curb width for calculations.

jj. Depict the total proposed pay quantities on a location and summary sheet. Use same Item Numbers as shown on Tabulations Sheets associated with and required for construction of concrete curb ramps.

kk. Submit PennDOT form titled "Technically Infeasible Form" (TIF) when applicable.

2. Revise submission material, as necessary, to obtain approval.

I. Submittal Review, Approval, and Distribution

1. Make all required submissions for each design activity to the following contacts:

   a. Submission to PennDOT as follows:

   PennDOT District 6-0
   7000 Geerdes Boulevard
   King of Prussia, PA 19406
   Attn: Fran Hanney, district ADA Coordinator

   b. Submission to SEPTA as follows:

   SEPTA
   1234 Market Street, 12th Floor
Philadelphia, PA 19107
Attn: Mr. Alex Coll, Project Manager
Re: ADA Ramps D/B Submission
Ph: 215-580-8249

c. Initial submission review time is 10 working days.
   Subsequent submission review time is 5 working days.

d. No curb ramps may be constructed until approval from PennDOT is received.

END OF SECTION
SECTION 02533B
CONSTRUCTION OF CURB RAMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This work is the construction of concrete curb ramps as indicated on the approved curb ramp design drawings and applicable standards.

1.02 RELATED SECTIONS

A. Division 1 – General Requirements
B. Section 02533A – Design of Curb Ramps

1.03 REFERENCES

A. PennDOT Publication 408
B. PennDOT Publication 13, Design Manual Part 2
C. PennDOT Publication 72M, Roadway Construction Standards

PART 2 PRODUCTS

2.01 MATERIALS

A. In accordance with PennDOT Publication 408 Sections 630.2, 676.2 and 695.2, 804.2.

PART 3 EXECUTION

3.01 PREPARATION

A. In accordance with PennDOT Publication 408 Sections 630.3, 676.3, 695.3 and as follows:

1. Revise PennDOT Publication 408 Section 676.3(h) to add the following:

2. Construct plain cement concrete curb ramps at the locations indicated on the approved Design Curb Ramp Drawings; as shown on PennDOT Standard Drawings RC–67M and RC–64M; and meeting the requirements of PennDOT Publication 13M, Design
Manual Part 2, Chapter 6. On PennDOT Standard Drawing RC-67M, the details depicted are most appropriate for new construction. Construct alterations to existing facilities to meet these requirements, unless a Technical Infeasibility Form (TIF) has been approved by the Department for each deficient location.

3. Do not start work in the vicinity of the proposed curb ramp until the drawings for the curb ramp are submitted and approved by PennDOT.

4. Minor utility adjustments such as, but not limited to, minor vertical adjustments of manholes, junction boxes, and valve boxes, etc. may be required. Coordinate with all necessary utility facility owners for adjustments to facilities for construction of the curb ramp. Coordinate all utility adjustments.

5. All minimum and maximum dimensions contained on PennDOT Standard Drawings RC-67M and RC-64M are absolute. Construction tolerances do not apply when a dimension is shown as minimum or maximum. Check all slopes with a Digital Display Level as specified in PennDOT Publication 408 Section 609.2(e)3 for compliance. An acceptance certificate will not be issued if any newly constructed curb ramps do not fully comply with the approved curb ramp design drawings and applicable standards.

6. Install Detectable Warning Surface (DWS) for all curb ramps as specified in PennDOT Publication 408 Section 695, unless excluded by PennDOT Publication 13M, Design Manual Part 2, Section 6.5.A.8.

7. Remove all existing sidewalk and curb to neat lines.

8. Grade areas behind the sidewalk that are within the work area to match the grade of the new sidewalk and existing topography so the area will drain. Place topsoil as necessary and seed the area with Seeding and Soil Supplements, Formula B and apply mulch.

9. If a new curb ramp is being placed at a quadrant of an intersection where there is an existing curb ramp, but not at the same location of the placement of the proposed ramp, remove the existing depressed curb and replace with necessary curb to tie into the new curb cut ramp. Remove the existing curb ramp and replace with the appropriate sidewalk or topsoil at a grade to meet the new curb ramp facility.

10. Any temporary construction activities required for alterations that affect existing Pedestrian Access Routes (PAR) will require the provision of a safe, alternate, and accessible pedestrian route.
around the construction activities. Provide alternate access in accordance with PennDOT Publication 13M, Design Manual Part 2, Section 6.14 Temporary Alternate Circulation Paths at Construction Sites to the maximum extent feasible so that the usability of the alternate PAR is maintained. Maintain the alternate PAR through the duration of the construction activity.

11. Following the construction of each curb ramp, submit for review PennDOT Form CS-4401 to be completed by the Contractor or Contractor’s representative to evaluate that each constructed curb ramp compliance with the referenced Department standards. Reconstruct curb ramps that are found to be non-compliant as a result of the evaluation at no cost to the Department, unless the curb ramp in question had been authorized to be constructed through the use of an approved Technically Infeasible Form (TIF). Upon approval by the Representative, submit the electronic copy, in Excel format, PennDOT Form CS-4401.

12. An acceptance certificate will not be issued if any newly constructed curb ramp does not comply with the approved Design Curb Ramp Drawings and the PennDOT Standard Drawings RC-67M, unless a previously approved Technically Infeasible Form (TIF) has documented those element(s) that do not meet those the requirements are constructed to the maximum extent feasible.

END OF SECTION
SECTION 02534
POURED-IN-PLACE CONCRETE CURB

PART 1 GENERAL

1.01 SUMMARY

A. The work specified in this Section consists of furnishing and installing concrete curbs and combination curb and gutter.

B. Related Sections:
   1. Section 02220 – Grading, Excavation, and Backfill.
   2. Section 02501 – Superpave Asphalt Mix HMA Paving and Surfacing.
   3. Section 03300 – Cast-In-Place Concrete.

1.02 REFERENCES

A. ASTM International (ASTM):

B. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO M43, Standard Size of Coarse Aggregate for Highway Construction.

1.03 SUBMITTALS

A. Submit the following:
2. Mix design for each change of ingredients or ingredient sources, including admixtures.

3. Certificates of Compliance to specifications of materials provided as work of this Section.

PART 2 PRODUCTS

2.01 FORMS

A. Steel forms:

1. Approved flexible forms of steel or wood may be used for construction of circular curb where radius is 200 feet or less.

B. Forming:

1. Use acceptable metal forms, except on sharp curves and short tangent sections, where wood forms may be used if acceptable to the SEPTA Project Manager.

2. Forms shall extend full depth of the concrete.

2.02 MATERIALS

A. Concrete: Concrete conforming to requirements of Section 03300 except use No. 8 coarse aggregate, conforming to AASHTO M43, for concrete placed by extrusion method.

1. Maximum Slump: 3 inches. For curbs placed by extrusion, maximum slump: 1½ inches.

2. Class A, Compressive strength 3300 psi at 28 days minimum.

B. Preformed Expansion Joint Filler:

1. Fiber Type, ASTM D1751.


C. Joint Sealer:


2. Cold-applied: Elastomeric type, ASTM C920.
PART 3 EXECUTION

3.01 PREPARATORY WORK

A. Excavation: Excavate to the required depth, then compact the material upon which the curb is to be constructed to a firm, even surface.

B. Forms

1. Erect forms true to line and grade.

2. Secure forms in place with iron stakes spaced on not more than four-foot centers.

3. Indicate line and grade of curb tops by an offset guideline for extrusion placement.

3.02 CONSTRUCTION

A. Placing Concrete:

1. Cast-In-Place: Conform to requirements of Section 03300 except place the concrete in the forms in layers not exceeding 5 inches in depth when spading, or layers not exceeding 15 inches in depth when using a vibrator to eliminate voids.

2. By extruding machine (where approved by the SEPTA Project Manager):

   a. Uniformly feed the concrete to the machine so that concrete maintains the shape of the section without slumping after extrusion.

   b. Voids or honeycombs on the surface of the finished curb will not be allowed. Apply any additional surface finishing required immediately after extrusion.

B. Joints: Construct joints as follows:

1. Expansion Joints:

   a. Space expansion joints at 30’ maximum or to match the adjoining sidewalk.

   b. Place ½-inch preformed expansion joint filler at expansion joints, at ends of curb returns, and at junctures with structures. Place filler in single piece conforming to curb cross-section and depressed ½ inch below finished surface.
c. Where curb is constructed in conjunction with adjacent sidewalk, the expansion joint in the curb and sidewalk shall coincide.

2. Contraction Joints:
   
a. For curb not constructed integrally with new base or pavement, form or saw contraction joint $\frac{3}{16}$ inch wide to a depth of $\frac{1}{5}$ of the curb height at 10-foot intervals. Saw as soon as possible after the concrete has set sufficiently to preclude raveling during the sawing.

b. Fill joint with hot-applied joint sealer.

3. Tool the edges of all joints adjacent to expansion filler to a $\frac{1}{4}$-inch radius, leaving all joints free of mortar and concrete. Leave the joint filler exposed for the full length of the joint with clean and true edges.

C. Removal of Forms: Do not remove forms until such time that it will not be detrimental to the concrete. Correct irregular faces by rubbing with a carborundum stone.

D. Finishing:
   
1. Finish top edge of face to a one inch radius.

2. Trowel curb faces smooth either to a depth of not less than two inches below top of pavement or to the flow line of integral curb and gutter. Hand finish the face of curb with a steel trowel.

3. Provide a final fine brush finish to the top and face of curb with brush strokes parallel to the line of the curb.

4. Allow no coarse aggregate to show on the finished curb surface.

E. Curing: Conform to requirement of Section 03300, except that liquid membrane curing compound shall not be used on curb when temperature tends to go lower than 40 degrees F within 24 hours after application.

F. Sealing Joints:
   
1. Seal all expansion joints, all joints between curb and vehicular pavements, and all joints between gutters and vehicular pavements to within $\frac{1}{16}$ inch of the surface. (Do not seal other joints unless otherwise indicated or directed by the SEPTA project Manager).

2. Seal joints with (poured) joint sealer in conformance with the manufacturer's recommendations.
G. Backfilling:

1. As soon as possible after the removal of forms, and finishing as specified herein, backfill the voids in front and back of the curb using acceptable embankment material as specified in Section 02220.

2. Complete embankments in back of raised curb, as indicated, and as specified in Section 02220, except carefully compact the embankment by means of mechanical tampers, or rollers, if permitted, not exceeding 8 tons.

3. Where curbs are constructed in existing paved areas, all backfill between curb face and pavement shall be made with bituminous concrete base course material, thoroughly compacted in place in accordance with Section 02501.

END OF SECTION
SECTION 02580

PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section covers the furnishing and installation of hot thermoplastic pavement markings, of the indicated type and color with a surface application of glass beads.

1.02 RELATED SECTIONS

A. Division 1 – General Requirements.

1.03 REFERENCES

A. PENNDOT Publication 408, Section 960.

PART 2 PRODUCTS

2.01 MATERIALS

A. As per PENNDOT Publication 408, Section 960.2.

PART 3 EXECUTION

3.01 PREPARATION

A. As per PENNDOT Publication 408, Section 960.3 and as shown on the contract drawings.

END OF SECTION
SECTION 02606
ADJUSTMENT OF UTILITY STRUCTURE TOPS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: The work specified in this Section consists of the grade adjustment of existing inlets, manholes, or utility boxes to new grade elevations.

B. Related Sections:

1. Section 02050 – Demolition.

1.02 REFERENCES

A. ASTM International (ASTM):


4. ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

5. ASTM A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

6. ASTM C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.


B. American Association of State Highway and Transportation Officials (AASHTO) Standards as referenced throughout these Specifications.

C. American Concrete Institute (ACI).
   1. ACI 304, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
   2. ACI 308, Guide to Curing Concrete.
   3. ACI 318, Building Code Requirements for Structural Concrete.

1.03 SUBMITTALS

A. Submit manufacturer's descriptive literature and specifications covering the product specified. Include installation information.

B. Certificates: Submit certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.
   1. Manufacturer's sworn certification that components and products will be manufactured in accordance with specified reference standards for components and products.
   2. Manufacturer's sworn certification that the materials used are in compliance with the specified requirements.

1.04 QUALITY ASSURANCE

A. Precast Concrete Producer Qualifications: Provide documentation from the precast concrete unit producer that their products have been in continuous service for five years minimum.

B. Design Criteria: Provide documentation that the precast concrete units are designed to meet the minimum structural loading requirements of AASHTO HS20-44, ACI 318, and the loads exceeding AASHTO and ACI requirements as may be indicated on the Drawings.

C. Certifications:
   1. Obtain certificate of construction compliance with ASTM C478 from the precast concrete unit manufacturer. Submit same certificate as part of required submittals.
2. Obtain certificate of material compliance with ASTM A48, Class 30 tensile strength from the manhole frame and cover manufacturer. Furnish certification that tensile test bars were from same pour as castings. Submit the certificates as part of required submittals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Transport and handle precast concrete units and their associated components, and other products specified herein, in a manner recommended by their respective manufacturers to prevent damage and defects of whatever nature.

B. Through-wall lifting holes are not permitted in structure component construction.

C. Storage: Store precast concrete structure components in accordance with their manufacturer's recommendations to prevent joint damage and joint contamination. Exercise such care in storage of other specified products as recommended by their respective manufacturers.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Frame Extensions:

1. Castings conforming to ASTM A48, Class 35B. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion, or other defects. Frame and cover design and dimensions as indicated on Drawings.

   a. Gray iron castings conforming to AASHTO M 105 (ASTM A48), Class No. 207.

   b. Malleable iron castings conforming to ASTM A47, Grade 24018.

   c. Ductile iron castings conforming to ASTM A536, Grade 60-40-18 unless otherwise specified.

   d. Sandblast all castings or otherwise effectively clean scale and sand so as to present a smooth, clean, and uniform surface.

2. Provide casting designed for AASHTO H-20 loading.

3. Fabricate the extensions to conform to the shape of the original castings. They may be either welded in place or secured by a swedge fit. Weld according to the manufacturer’s
recommendations. Provide a locking device to ensure the swedge fit is permanent.

4. Acceptable Manufacturer:
   a. PENNDOT Bulletin 15.
   b. Or approved equal.

2.02 PRECAST CONCRETE COMPONENTS

A. Manufacturers:
   1. PENNDOT Bulletin 15.

B. Materials and Fabrication: Provide steel reinforced precast concrete structure of either one piece construction, or component construction, conforming to the following:
   1. Forming: Use form of sufficient design and bracing to maintain alignment and prevent deforming under pressure during pouring and vibrating of concrete.
   2. Reinforcing: Bars conforming to ASTM A615 Grade 60, and wire fabric conforming to ASTM A1064.
   3. Concrete: Composed of Portland cement conforming to ASTM C150, Type 1 and aggregate conforming to ASTM C33. Both fine and coarse aggregates shall be free of deleterious substances which cause reactivity with oxidized hydrogen sulfide. Materials shall be accurately weighed at a certified central batching facility prior to mixing. Concrete mixture shall contain cement content in amounts adequate to produce a minimum strength of 5,000 psi concrete at 28 days.
   4. a. The concrete strengths shall be as confirmed by cylinder strength tests in accordance with ASTM C31 and ASTM C39.
   5. Placing: Pour concrete in a continuous operation, without segregation or loss in ingredients, until completion of unit; all in accordance with ACI 304. Consolidate concrete by mechanical internal vibrating equipment.
   6. Curing: In general, perform concrete curing by water curing, sheet form curing, or sealing methods; all in accordance with ACI 308.
a. If steam curing is used, cure units in forms after initial set at temperatures not to exceed 160 degrees F with temperature rise above ambient not to exceed 40 degrees F per hour.

b. After steam curing and form stripping continue curing by water spray or liquid membrane curing using compounds conforming to ASTM C309.

C. Precast Concrete Leveling/Adjusting Units: Provide units of size to accommodate existing structures and castings, of not less than two inches thickness, and of materials and construction as specified in Section 2.02.B.

D. Waterproof Coating: Of materials as specified previously, and either shop or field applied to the precast concrete components.

1. Apply coating in two coats at the rate of 75 to 100 square feet per gallon per coat. Allow 24 hours drying time between coats.

E. Waterproofed Mortar: Conforming to requirements of ASTM C270 for Type M, 2500 psi. Parts by volume include: One part cement, 1/4 part lime, and sand at not less than 2-1/4 nor more than three times the sum of the volumes of cement and lime used.

F. Preformed Plastic Sealing Compound: Use for section-to-section precast component joint sealing. Provide product conforming to Fed. Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound, and shipped protected in a removable two-piece wrapper.

1. Dimensions: Size the cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference of each structure section joint when joint is completed.

G. Waterproofing Agent: Medusa Waterproofing Powder by Medusa Portland Cement Co.; Hydratite by Grace Construction Materials; or Hydroloxy by Chem-Master Corp. Add the Medusa product in the ratio of two pounds per bag of cement; add the other products per manufacturer’s recommendations.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove existing pavement as specified in Section 02050: Demolition.
1. Protection: During removal operations, keep pipe or conduit and structure interiors cleared of debris as construction progresses.

2. Carefully remove and clean existing castings.

### 3.02 CONSTRUCTION METHODS

#### A. Precast grade rings:

1. Set precast grade rings in Water-proof Mortar, of thickness not to exceed 3/4 inch maximum and 3/8 inch minimum. Wet, but do not saturate precast grade rings immediately before laying.

2. Pre-set to proper plane and elevation using wedges or blocks of cementitious material not exceeding one square inch wide on all sides. No more than four wedges or blocks per grade ring permitted. Incorporate wedges or blocks in fresh mortar in a manner to completely encase each. Crown fresh mortar to produce squeeze-out between grade rings. Tool exposed joints with appropriately shaped tool and compact mortar edge into joints. Clean off excess mortar prior to initial mortar set.

3. Bolt manhole frames in place on manhole top section, or on leveling units if required, after installing 1/2 inch thick preformed plastic sealing compound on bearing surface of casting frame. Remove excess sealing compound squeeze-out after manhole frame is bolted in place.

4. Use bolts of sufficient length to properly pass through leveling units, if any, engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer. Tighten manhole frame bolts after mortar has cured.

### 3.03 FIELD QUALITY CONTROL

#### A. General: Make a visual inspection of each unit constructed to ensure compliance with installation requirements.

1. Repair or replace defective materials and workmanship, as is the case, and conduct such additional inspection and such subsequent repairs as required until manholes and inlets meet requirements.

2. Materials and methods used to make repairs must meet with SEPTA Project Manager’s approval prior to use.

3. Make repairs and replacements at no additional expense to SEPTA.
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Precast or cast-in-place cylindrical concrete manhole components and accessories, other than storm drainage manholes. See Section 02720 for storm drainage manholes.

B. Related Sections:

1. Section 01401 - Quality Requirements.
2. Section 02222 – Excavation, Backfill, and Compaction for Utilities.
3. Division 3 - Concrete.
4. Section 03300 - Cast-In-Place Concrete.
5. Section 05500 - Metal Fabrications.

1.02 SUBMITTALS

A. Shop Drawings and Product Data:

1. Manufacturer's published detail drawings, modified to suit design conditions if required, and Contractor prepared drawings as applicable.

2. Manufacturer's descriptive literature and specifications covering the product specified. Include installation information.

3. Shop Drawings to indicate types of materials, dimensions, and details including location of reinforcement, inserts, anchors, connections, accessories, joints, openings, and setting details.

B. Certificates:

1. Certified records or reports of results of shop tests, such records or reports to contain a sworn statement that shop tests have been made as specified.

2. Manufacturer’s sworn certification that components and products will be manufactured in accordance with specified reference standards for components and products.
C. Design Calculations: Submit structural calculations for structures furnished under this Section. Have calculations sealed and signed by a Registered Professional Engineer.

1.03 QUALITY ASSURANCE

A. Services of Inspection and Testing Agency will be used for this work. See Division 1.

B. Referenced Codes and Standards: Comply with the following in accordance with Division 1.

1. American National Standards Institute (ANSI):

2. ASTM International (ASTM):
   c. ASTM A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   d. ASTM C32, Standard Specification Sewer and Manhole Brick (Made from Clay or Shale).
   e. ASTM C270, Standard Specification for Mortar for Unit Masonry.
   f. ASTM C361, Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
   h. ASTM C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.

3. American Water Works Association (AWWA):
   a. AWWA C302, Standard for Reinforced Concrete Pressure Pipe Noncylinder Type.
4. Federal Specifications:

1.04 QUALITY ASSURANCE

A. Quality Control:
   1. Maintain uniform quality of products and component compatibility by using products of one manufacturer in the case of precast reinforced concrete manholes.

B. Certifications:
   1. Obtain certificate of construction compliance with ASTM C478 from the precast reinforced concrete manhole manufacturer. Submit same certificate as part of required submittals.
   2. Obtain certificate of material compliance with ASTM A48, Class 30 tensile strength from the manhole frame and cover manufacturer. Furnish certification that tensile test bars were from same pour as castings. Submit same certificates as part of required submittals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Transport and handle precast reinforced concrete manhole components and other Products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects.

B. Store precast reinforced concrete manhole components in accordance with manufacturer's recommendations to prevent joint damage and contamination. Exercise such care in storage of other specified Products as recommended by the respective manufacturers.

PART 2 PRODUCTS

2.01 BASIC MATERIALS

A. Cast-In-Place Concrete Products: Formwork, Reinforcement, and Cast-In-Place Concrete per requirements of Division 3 - Concrete.

B. Waterproofed Mortar: Material composition meeting requirements of:
   1. ASTM C270, Type M with waterproofing admixture included.
   2. Medusa Cement Company; Medusa Waterproofing Paste or Powder.
5. Or equal.

C. Epoxy Bonding Compound: Use product such as W. R. Grace Epoxite Binder, Sika Chemical Colma-Fix or equal.

D. Manhole Brick: Commercially manufactured brick made from clay or shale and burned, meeting requirements of ASTM C32, Grade MS.

E. Manhole Steps: Provide steps with minimum width of 10 inches, minimum projection from wall of 5\(\frac{3}{8}\) inches, unless indicated otherwise on Drawings.
   2. Reinforced Plastic Step: Composed of a 1/2 inch Grade 60, ASTM A615 deformed steel reinforcing bar completely encapsulated in polypropylene copolymer compound conforming to ASTM D4101; M. A. Industries, Inc., Type PS4, or equal.


G. Manhole Frame and Cover: Gray iron castings conforming to ASTM A48, Class 35B. Provide castings of uniform quality, free from blowholes, porosity, hard spots, shrinkage distortion, or other defects. Frame and cover design and dimensions as indicated on Drawings. Provide casting designed for AASHTO H-20 loading.
   1. Finish: Bearing surfaces machined to prevent rocking and rattling.
   2. Identification: Cast the applicable word WATER, WASTEWATER, OVERFLOW, SANITARY, DRAIN, ELECTRIC, TELEPHONE, or other as indicated on Drawings, integrally on cover in 2 inch size raised letters.
   4. Tensile Test Bar: Size B, cast separately, but poured from same iron as castings they represent.
   5. Aluminum Inner Cover: Fabricate from aluminum alloy 6061-T6 sheet or plate to dimensions indicated on Drawings. Provide cover with vents and lift handle.
6. **Aluminum Castings**: Provide aluminum castings, where indicated on Drawings, as specified in Section 05500.

7. **Cover Gasket**: One piece O-ring gasket factory installed in a machined rectangular or dovetail groove in the cover bearing surface.
   

8. **Acceptable Manufacturer**:
   
   
   b. Or approved equal.

H. **Preformed Plastic Sealing Compound**: Fed. Spec. SS-S-210A, Type 1, Rope Form, of either bitumastic base compound or butyl rubber base compound, and shipped protected in a removable two-piece wrapper.
   
   1. Size cross-section of rope form to provide squeeze-out of material around entire interior and exterior circumference when joint is completed.
   
   2. For applications in contact with potable water, provide preformed plastic sealing compound that is NSF 61 approved.

I. **Rubber Compression Gasket**: Composition conforming to ASTM C361 or ASTM C443.

J. **PVC Waterstop**: Gasket type waterstop composed of virgin polyvinyl chloride (PVC) such as manufactured by Fernco Joint Sealer Co.; CMA Concrete Manhole Adapter.

2.02 **PRECAST REINFORCED CONCRETE MANHOLE COMPONENTS**

A. **Materials and Construction**: Conforming to requirements specified in ASTM C478 except as follows:

   1. **Concrete**: Composition and compressive strength conforming to ASTM C478 except use Type II or Type III cement in manhole components and increase compressive strength to 4500 psi (at 28 days) in precast bases.
   
   2. **Casting and Curing**: Wet cast and steam curing process in accordance with Section 3.6.11 and 3.7.2 of AWWA C302.
3. Lifting Holes and Lugs: Thru-wall holes not permitted in manhole component construction. Factory install lifting keys or lugs integrally in manhole components.

4. Manhole Steps: Factory installed in manhole components, pre-aligned vertically, spaced on equal centers, and located the minimum distance from ends of risers and top sections as indicated on Drawings.

5. Manhole Component Seals: Manhole component joints factory formed for self-centering concrete to concrete bearing employing either a rubber compression gasket or preformed plastic sealing compound.

6. Manhole Component Design: Base, riser section and top section dimensions and diameters, not consistent with ASTM C478, are as indicated on Drawings.

7. Joints and riser sections shall be water tight.

B. Precast Bases and Riser Sections: Design, materials, and construction as specified previously.

C. Precast Top Sections: Design as indicated on Drawings, of materials and construction as specified previously except additional and differing requirements as follows:

1. Flat Slab Tops: Tops factory formed to properly accept and support required manhole frame and cover and formed to join riser section in a matching joint.

2. Eccentric Cone Tops: Manufacture to same minimum wall thickness and with same area of circumferential steel reinforcement as riser sections.

3. Hold Down Bolt Inserts: Factory cast in top section no less than two 3/4 inch threaded inserts or slotted inserts to accommodate manhole frame hold down bolts. Threaded inserts of 3 inches depth. Both insert types designed for an ultimate load in tension of 12,500 pounds. Inserts factory plugged for shipping. Coordinate insert location with manhole component manufacturer to assure proper location in top sections.

D. Precast Grade Rings: Leveling and adjusting units of 3 inch or 4 inch thickness, and of materials and construction as specified previously. Factory cast grade rings with hold down bolt holes matching location of same in manhole frame. Split rings not permitted. Design must provide for full bearing of manhole frame.
PART 3 EXECUTION

3.01 INSPECTION

A. Inspect precast reinforced concrete manhole components in accordance with requirements of ASTM C478 regarding repairable defects and defects subject to rejection by the SEPTA Project Manager.

3.02 PREPARATION

A. Keep pipe and manhole interiors cleared of debris as construction progresses.

B. Earthwork: Perform earthwork for manhole installation as previously specified in Section 02222.

3.03 MANHOLE CONSTRUCTION METHODS

A. Cast-In-Place Concrete Manhole Base: Construct in accordance with design and dimensions indicated on Drawings. When necessary to construct wider or deeper manhole bases than indicated or specified, build such bases as required by the SEPTA Project Manager.

1. Form and pour concrete in accordance with requirements of Division 3 - Concrete. Additional requirements as follows:

   a. Vibrate poured concrete using mechanical vibrator of a type and design approved by SEPTA Project Manager. Use vibrators of type capable of transmitting vibration to concrete in frequencies of not less than five thousand impulses per minute.

   b. Form and pour joint monolithically in manhole base top to match joint of adjoining precast riser section. Use template as obtained from precast concrete manhole component manufacturer of manhole components used in the Project.

2. Use Class A (4000 psi) concrete as specified in Section 03300, unless indicated otherwise on Drawings.

B. Manhole Wall Erection: Provide precast reinforced concrete straight riser and top sections necessary to construct complete manholes. Fit the different manhole components together to provide watertight jointing and true vertical alignment of manhole steps.

1. If rubber compression gaskets are used between sections, install gaskets and join sections in accordance with written instructions of manhole component manufacturer.
2. If preformed plastic sealing compound is used between sections, install sealing compound in accordance with manufacturer's recommendations, and join sections in accordance with written instructions of manhole component manufacturer.

a. Prime joint surfaces if required by preformed sealing compound manufacturer.

b. If sealing compound is installed in advance of section joining leave exposed half of two piece protective wrapper in place until just prior to section joining.

c. Use preformed sealing compound as the sole element utilized in sealing section joints from internal and external hydrostatic pressure.

d. Following manhole section installation, trowel sealing compound surface smooth and flush with interior face of manhole.

C. Frame and Cover Installation: Where required, make final adjustment of frame to elevation using materials specified in Part 2 Products.

1. Set precast grade rings or bricks in Water-proof Mortar. Mortar thickness not to exceed 3/4 inch maximum and 3/8 inch minimum. Wet, but do not saturate precast grade rings immediately before laying. Saturate brick immediately before laying.

2. Precast grade ring: Pre-set to proper plane and elevation using wedges or blocks of cementitious material not exceeding one square inch wide on all sides. No more than four wedges or blocks per grade ring permitted. Incorporate wedges or blocks in fresh mortar in a manner to completely encase each. Crown fresh mortar to produce squeeze-out between grade rings. Tool exposed joints with appropriately shaped tool and compact mortar edge into joints. Clean off excess mortar prior to initial mortar set.

3. Brick Leveling Units: Lay brick to line and in header courses. Lay each course to stagger 1/2 brick over previous course. Completely fill joints and make close joints not exceeding 1/4 inch on inside face of manhole. In making closures, use no portion of a brick less than the width of a brick, and whenever practical use whole brick laid with long side at right angles to inside face of manhole wall. Finish brick work with neatly struck and pointed joints. Clean brick work by removing mortar smears and drippings.

4. Parge the outside of finished brick with a minimum of 1/2 inch thick waterproof mortar.
5. Bolt manhole frames in place on manhole top section, or on leveling units if required, after installing 1/2 inch thick preformed plastic sealing compound on bearing surface of manhole frame. Remove excess sealing compound squeeze-out after manhole frame is bolted in place.

6. Use bolts of sufficient length to properly pass through leveling units, if any, engage full depth of manhole top section inserts and allowing enough threaded end to pass through manhole frame to properly tighten nut and washer. Tighten manhole frame bolts after mortar has cured.

D. Pipe Connections: Make pipe connections to manholes as indicated on Drawings.

3.04 FIELD QUALITY CONTROL

A. General: Make a visual inspection of each manhole constructed to ensure compliance with installation requirements.

B. Test each sanitary manhole constructed in the Project by the exfiltration method.

1. Conduct tests in presence of and to complete satisfaction of the SEPTA Project Manager.

2. Should a manhole not satisfactorily pass testing, discontinue manhole construction in the Project until such manhole does test satisfactorily.

3. Provide tools, materials (including water), equipment, and instruments necessary to conduct manhole testing specified herein.

4. If the manhole is constructed on an existing sewer where sewage flow must be maintained, the exfiltration test will be waived.

C. Manhole Acceptance Test: Prior to testing manholes, thoroughly clean such and seal openings, both to complete satisfaction of the SEPTA Project Manager. Seal openings watertight using properly sized plugs.

1. Test Procedure:

   a. Completely fill manhole with water.

   b. Allow water filled manhole to stand four hours prior to testing to allow absorbing in materials.
c. At commencement of test, fill manhole to top of manhole frame and cover.

d. During a consecutive four hour period keep an accurate record of the amount of water to be added because of exfiltration. Acceptable limits of exfiltration as follows:

2. Consider manholes "Acceptable" when exfiltration rate does not exceed a rate of 0.038 gallons a day per inch of manhole diameter per vertical foot of manhole.

D. Repair and Retest: Determine source or sources of leaks in manholes failing acceptable limits of exfiltration.

1. Repair or replace defective materials and workmanship, as is the case, and conduct such additional Manhole Acceptance Tests and such subsequent repairs and retesting as required until manholes meet test requirements.

2. Materials and methods used to make manhole repairs must meet with SEPTA Project Manager's approval prior to use.

3. Make repairs, replacements, and retests at no additional expense to SEPTA.

END OF SECTION
SECTION 02609

PIPE CULVERTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section covers the furnishing and installation of pipe culverts and
storm drains; including the direct design, manufacturing and testing of
reinforced concrete pipes.

1.02 RELATED SECTIONS

A. Division 1 – General Requirements.

1.03 REFERENCES

A. PENNDOT Publication 408, Section 601.

PART 2 PRODUCTS

2.01 MATERIALS

A. As per PENNDOT Publication 408, Section 601.2.

PART 3 EXECUTION

3.01 PREPARATION

As per PENNDOT Publication 408, Section 601.3 and as shown on the contract
drawings.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: The work specified in this Section consists of construction of the water service connections and appurtenances.

B. Related Sections:
   1. Section 02050 - Demolition.
   2. Section 02222 - Excavation, Backfill, and Compaction for Utilities.
   3. Section 03300 - Cast-In-Place Concrete.

1.02 REFERENCES

A. American National Standards Institute (ANSI)/American Water Works Association (AWWA):
   1. ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ in. Through 3 in. for Water Service.
   2. ANSI/AWWA C651 Standard for Disinfecting Water Mains.

B. ASTM International (ASTM):
   1. ASTM D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

6. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) and Crosslinked Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure.


1.03 SUBMITTALS

A. Shop Drawings and Product Data:

1. Manufacturer's published detail drawings, modified to suit design conditions if required, and Contractor prepared drawings as applicable.

2. Manufacturer's descriptive literature and specifications covering the product specified. Include installation information.

B. Certificates: Certified records or reports of the results of shop tests; such records or reports to contain a sworn statement that shop tests have been made on the products specified in order to be in compliance with the Referenced Standard for each particular product.

1.04 QUALITY ASSURANCE

A. Source Quality Control:

1. Shop Tests: In accordance with the General Conditions. Perform tests in accordance with the requirements of the local water utility or local plumbing code.

B. Laboratory Tests: The SEPTA Project Manager reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish without compensation, labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory. These laboratory tests will be provided at no additional cost to SEPTA.

C. Requirements of Regulatory Agencies:

1. General Requirement: Comply with construction requirements of State, County, or other political subdivision, which requirements exceed these Specifications.
2. **Water Service:** Consult SEPTA, the local water utility, and the local municipality for specific requirements concerning the work of connecting into the public water system and materials and methods to be used for such connection.

### 1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. **Delivery and Handling:** Transport and handle products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects.

B. **Storage:** Store Products in accordance with manufacturer's recommendations to avoid shock or prevent physical damage and defects.

C. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe.

D. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use.

### 1.06 SITE CONDITIONS

A. **Environmental Requirements:**

1. Keep trenches dewatered until pipe joints have been made and concrete work, if any, has cured.

2. Under no circumstances lay pipe in water or on bedding containing frost.

3. Do not lay pipe when weather conditions are unsuitable, as determined by the SEPTA Project Manager, for pipe laying work.

B. **Seasonal Restrictions:** Where seasonal restrictions are not specified in Water Service requirements, restrict work of uncovering and connecting to existing water mains to the time period between May first and October first. This requirement may be waived at the discretion of the SEPTA Project Manager depending on environmental conditions if at the request of the Contractor another time for connection is desired.

C. **Protection:**

1. Exercise care during piped utility uncovering and connecting work to confine operations to the facilities as indicated on the Drawings. The physical means and methods used for protection are at the Contractor's option. However, the Contractor will be completely responsible for replacement and restitution work of whatever nature to adjacent structures and construction.
2. Exercise every precaution against flotation of both existing and new pipe and in-line or on-line structures. Correct damage from flotation to the satisfaction of the SEPTA Project Manager.

PART 2 PRODUCTS

2.01 WATER SERVICE PIPE

A. Polyethylene Pipe:

1. Polyethylene pipe shall be made from a HDPE material having a minimum material designation code of PE 4710 or PE 3608. The material shall meet the requirements of ASTM D3350 and shall have a minimum cell classification of PE445474C for PE 4710 and PE345464 for PE 3608. In addition, the pipe shall be listed as meeting NSF-61.

2. The pipe shall meet the requirements of AWWA C901.

3. HDPE pipe shall be rated for use at a pressure class of 250 psi. The outside diameter of the pipe shall be based upon the SIDR rating system.

2.02 FITTINGS

A. Butt Fusion Fittings:

1. Fittings shall be made of either PE4710 or PE3608, with a minimum Cell Classification as noted in 2.01 A. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans.

2. Markings for molded fittings shall comply with the requirements of ASTM D3261. Fabricated fittings shall be marked in accordance with ASTM F2206. Socket fittings shall meet ASTM D2683.

B. Electrofusion Fittings:

1. Fittings shall be PE4710 or PE3608, with a minimum Cell Classification as noted in 2.01 A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a pressure rating equal to the pipe unless otherwise specified on the plans.

C. Flanges and Mechanical Joint Adapters (MJ Adapters):
1. Flanges and Mechanical Joint Adapters shall be PE4710 or PE3608, with a minimum Cell Classification as noted in 2.01 A. Flanged and Mechanical Joint Adapters can be made to ASTM D3261 or if machined, must meet the requirements of ASTM F2206. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Marking for molded or machined flanged adapters shall be per ASTM D3261. Fabricated (including machined) flange adapters shall be per ASTM F2206.

D. Service connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion branch saddles, tapping tees, or mechanical saddles.

E. For electrofusion saddles with threaded outlet, the size of the outlet shall be one inch IPS unless a larger size is shown on the plans. Electrofusion saddles shall be made from materials required in part 1.02 B.

F. For sidewall fusion saddles, the size of the saddle shall be as indicated on the plans. The saddle can be made in accordance to ASTM D3261 or ASTM F2206. After installation, approximately ¼” of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide ¼ inch of area beyond the saddle are not acceptable.

G. Tapping tees shall be made to ASTM D3261 or ASTM D2683.

H. Mechanical strap-on saddles can only be used where their use on PE pipe is approved by the mechanical saddle manufacturer. The body of the saddle shall be stainless steel, epoxy coated cast iron or brass. The gasket material and design must be acceptable for PE pipe. The outlet shall be threaded for one inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed per the manufacturer’s instructions.

2.03 PIPE AND FITTING IDENTIFICATION

A. The pipe shall be marked in accordance with the standards to which it is manufactured.

B. Tracing wire shall be placed parallel and above, but separate from the pipe.

C. Marking tape shall be approved by the SEPTA Project Manager and placed 6 to 12 inches above the crown of the pipe.
PART 3 EXECUTION

3.01 EXAMINATION

A. Field Inspection: Inspect each section or length of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.

B. Rejected Products: Remove rejected Products from the Project site and replace with new Products at no increase in Contract Price.
   1. Pipe already laid and later found defective will not be accepted and shall require its replacement at no increase in Contract Price.

3.02 PREPARATION

A. Field Measurement: The Drawings are in general indicative of the Work with symbols and notations for clarity. However, the Drawings are not an exact representation of all conditions involved, therefore, layout piping to suit actual field measurements.
   1. No extra compensation will be made for Work due to differences between indicated and actual dimensions.
   2. Submit details of proposed departures necessitated by field conditions or other causes to SEPTA Project Manager for approval.

B. Earthwork: Perform earthwork for buried piping as specified in Excavation, Backfill and Compaction for Utilities: Section 02222.
   1. Rest each section of pipe on pipe bedding for the full length of its barrel, with recesses excavated for pipe joints so joints can easily be made.
   2. Backfill recesses with bedding material immediately following pipe joining operations.

C. Cleaning: Clean piping interior prior to installation and following installation. Keep open ends of piping and pipe attachment openings on equipment capped or plugged until actual connection.

3.03 INSTALLATION

A. General Requirements:
   1. Use only the proper and suitable tools and apparatus for proper and safe handling, lowering into trench and laying of pipes.
2. Construct piping from full lengths of pipe using short sections only for runs of less than full pipe length.

3. Use reducing fittings where reduction in pipe sizes is necessary. Bushings will not be accepted.

4. Take up and relay pipe that is not laid true to required alignment or grade or has its joints disturbed after laying. No deviation from the required line and grade permitted, except with approval of the SEPTA Project Manager.

B. Pipe Laying and Joining: Perform pipe laying and joining in strict accordance with manufacturer’s instructions, reference standards as included, and such additional requirements as specified herein:

1. Exercise care when making the pipe joints and make joints in accordance with the pipe material manufacturer’s recommendations and the following requirements. In each instance of pipe joining, those portions of pipes involved must be absolutely clean just prior to assembly. If a joint is extremely difficult to assemble or sealing is not affected, disassemble the joint and correct the difficulty if possible. Remake the joint using new materials when necessary.

C. Water Service Pipe Installation:

1. Unless indicated otherwise, install piping with not less than four (4) feet of cover.

2. Strictly follow cutting recommendations and procedures of pipe manufacturer.

3. Setting Valves, Stops, and Boxes:
   a. Unless otherwise directed by the SEPTA Project Manager, set valves, curb stops and boxes truly vertical.
   b. Set valve and curb stop boxes neatly to grade and in such a way that the box does not transfer shock or stress to the valve or stop. Exercise care to center the box over the wrench nut of the valve or stop.

4. Connection to Existing Water Main: Make connection in conformance with the utility owner’s requirements exercising necessary precaution to prevent contamination to the existing main.
   a. CU Pipe Connection: Use corporation stop to make connection.
3.4 FIELD QUALITY CONTROL

A. General Requirements: Conduct tests specified herein so that each pipe line installed in the Project is tested to the SEPTA Project Manager's satisfaction.

1. Provide tools, materials (including water), apparatus, and instruments necessary for pipe line testing.

2. Conduct tests of every kind in the presence of and to the satisfaction of the SEPTA Project Manager.

3. Repair and Retest: When a pipe line fails to meet test requirements specified herein, conform to the following:
   a. Determine source or sources of leakage.
   b. Repair or replace defective material, and if a result of improper workmanship, correct such.
   c. Conduct additional tests to demonstrate that pipe line meets specified test requirements.

4. Accuracy Proof: Furnish acceptable proof to the SEPTA Project Manager that testing apparatus, pressure gauges, etc. have been recently checked and calibrated as applicable prior to use on this Project.

5. Notification: Give the SEPTA Project Manager a minimum of three (3) days advance notice of the times when pipe line acceptance testing will be conducted.

B. Water Service Pipe Line Testing and Disinfecting:

1. General: Conduct testing and disinfecting in accordance with the Water Service utility requirements, or in accordance with the following requirements, whichever is more stringent.
   a. Prior to testing, allow those installed sections of water piping protected by concrete reaction blocking to stand undisturbed for at least seven (7) days from concrete pour. Provide temporary blocking as required.
   b. The Contractor may, at his option, completely backfill the trench or partially backfill the trench over the center section of each pipe length prior to performing the pressure test.
c. Fill the section of installed water piping being tested with water a minimum of (24) twenty-four hours prior to testing. During filling insure the piping is free of air. Use potable water for filling.

2. Line Acceptance Test:
   a. Hydrostatic leakage testing is recommended and shall comply with ASTM F2164, ASTM F1412, AWWA Manual of Practice M55 Chapter 9 and PPI Handbook of Polyethylene Pipe.
   b. If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to SEPTA.
   c. Pneumatic (compressed air) leakage test of HDPE pressure piping is prohibited for safety reasons.

3. Disinfection of Water Line: Disinfect the pipe and connections installed as follows:
   a. Cleaning and disinfecting of potable water systems shall be in accordance with AWWA C651 and AWWA Manual of Practice M55 Chapter 10, and PPI Handbook of Polyethylene Pipe.
   b. After installation and pressure testing, new water lines will be disinfected according to AWWA C651.
   c. The disinfection chemicals shall be limited to less than 12% active chlorine. The duration of the disinfection should not exceed 24 hours.
   d. Upon completion, the system should be thoroughly flushed with fresh water, and retested to verify the disinfectant chlorine level has been reduced to potable drinking water concentrations in all service water pipes.

END OF SECTION
SECTION 02720

STORM DRAINAGE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Project Site underground gravity storm water piping system for the building, driveways, and parking areas indicated.

1.02 SUBMITTALS

A. Submit per the requirements of Division 1.

B. Shop Drawings:

1. Before any equipment is installed, submit and obtain approval from the Engineer of the following, including information, data, and equipment, but not limited to:

   a. Size and location of all piping.

   b. Point and method of connection to building storm drainage system.

   c. Site location plan.

   d. Details of storm sewer pipe, precast manholes, manhole frames and covers, catch basins, drain inlets, curb inlets, and all appurtenances.

2. Submit all Shop Drawings and product catalog cuts at one time. Partial submissions will not be accepted.

C. Testing: Testing procedures for all new piping to the SEPTA Project Manager for approval.

D. Field Test Reports.

E. Record Drawings: To SEPTA’s Project Manager showing the location of all Work in accordance with Division 1.

1.03 QUALITY ASSURANCE

A. Services of Inspection and Testing Agency will be used for this work. See Division 1.
B. Referenced Codes and Standards: Comply with the following in accordance with Division 1.


2. ASTM International (ASTM):
   g. ASTM C913: Standard Specification for Precast Concrete Water and Wastewater Structures.
   i. ASTM C969, Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
PART 2  PRODUCTS

2.01 UNDERGROUND PIPE, VALVES, AND FITTINGS

A. Shall be of sizes and material indicated on the Drawings and shall conform to Piping Material Schedule “A(SU)”.

2.02 MANHOLES, CATCH BASINS, AND CURB INLETS

A. Construct manholes of precast reinforced concrete manhole sections meeting ASTM C478. Provide suitable rubber gasket joints, meeting ASTM C443, between sections. Pipe to manhole flexible seals shall conform to ASTM C923 and be as manufactured A-LOK Products, Corp., or approved equal. Manhole bases may be precast or case-in-place concrete. The top section of the manhole shall be the eccentric cone type so that manhole steps form a straight ladder. The entire outer surface of all precast concrete manholes shall be coated with two (2) coats of a bitumastic coating such as Koppers 300M Epoxy, Pennsburry 32-B-4 Epoxy or approved equal.

B. Provide manholes with cast-in-place rungs made of galvanized steel, with coating meeting ASTM A123, or aluminum meeting ASTM B221, Alloy 6061T6. Coat the embedded ends of aluminum rungs with two (2) coats of bituminous paint. Space rungs 12-inches center to center.

C. Catch basins, curb inlets, and other structures shall be of reinforced precast concrete conforming to ASTM C913. Basin and inlet bases may be precast or cast-in-place concrete.

D. Approved Manufacturer: Atlantic Concrete Products, Inc. or approved equal.

2.03 SCHEDULE A (SU)

A. Services: Storm Drainage (Underground)

B. ANSI Rating: N/A

C. Pressure/Temperature Limits: Atmosphere/Ambient

D. General Materials: Ductile Iron, Concrete
<table>
<thead>
<tr>
<th>Item</th>
<th>Pipe Sizes</th>
<th>Description</th>
<th>Reference Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe</td>
<td>12-inches and smaller</td>
<td>Ductile iron pipe.</td>
<td>ANSI/AWWA C151/A21.51 Thickness Class 52</td>
</tr>
<tr>
<td></td>
<td>15-inches and larger</td>
<td>Reinforced concrete culvert, storm drain and sewer pipe.</td>
<td>ASTM C76 Class III</td>
</tr>
<tr>
<td>Joints</td>
<td>12-inches and smaller</td>
<td>Bell and spigot ends.</td>
<td>ANSI/AWWA C111/A21.11</td>
</tr>
<tr>
<td></td>
<td>15-inches to 24-inches</td>
<td>Push-ons or bell and spigot ends.</td>
<td>ASTM C76 and ASTM C443</td>
</tr>
<tr>
<td></td>
<td>27-inches and larger</td>
<td>Bell and spigot or tongue and groove ends.</td>
<td>ASTM C76 and ASTM C443</td>
</tr>
<tr>
<td>Joining Materials</td>
<td>12-inches and smaller</td>
<td>Rubber compression-type gasket.</td>
<td>ANSI/AWWA C111/A21.11</td>
</tr>
<tr>
<td></td>
<td>15- inches to 24-inches</td>
<td>Rubber compression-type gasket.</td>
<td>ASTM C443</td>
</tr>
<tr>
<td></td>
<td>27-inches and larger</td>
<td>Rubber compression-type gasket.</td>
<td>ASTM C443</td>
</tr>
<tr>
<td>Fittings</td>
<td>12-inches and smaller</td>
<td>Ductile iron bell and spigot</td>
<td>ANSI/AWWA C110/A21.10</td>
</tr>
<tr>
<td></td>
<td>15-inches and larger</td>
<td>Reinforced concrete of the same weight as the pipe, with ends to suit pipe joints</td>
<td>ASTM C76</td>
</tr>
<tr>
<td>Joining Materials</td>
<td>18-inches to 30-inches</td>
<td>Closed-cell synthetic expanded rubber gasket</td>
<td>ASTM D1056, Classification 2A2</td>
</tr>
</tbody>
</table>

2.04 FRAMES, COVERS, AND GRATINGS

A. Manhole frames and covers shall be gray cast iron meeting, ASTM A48, Class 30B. Covers shall have the word “STORM SEWER” cast in the center. The bearing surfaces for the frames and covers shall be machine finished to prevent the covers from rocking and jamming in any position. Grind smooth all projections and roughness. No bituminous coating shall be applied.
B. Where manholes, catch basins and inlets are subject to vehicular traffic, provide heavy-duty traffic-bearing cast iron frames, covers and grating complying with AASHTO H-20-316 Highway Loading.

C. Approved Manufacturers: Neenah Foundry, Campbell Castings, or approved equal.

2.05 BURIED UTILITY WARNING AND IDENTIFICATION TAPE

A. Provide polyethylene plastic tape manufactured specifically for warning and identification of buried utility lines.

B. Tape shall be of the type provided in rolls, 6-inches minimum width, color-coded for the utility involved, with warning and identification imprinted in bold black letters continuously and repeatedly over the entire tape length.

C. Warning and identification of buried storm water lines shall read “CAUTION: STORM SEWER LINES BURIED BELOW” or similar.

D. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material.

E. Approved Manufacturers: Reef Industries, Inc., Seton Name Plate Corporation.

PART 3 EXECUTION

3.01 TRENCHING AND EXCAVATION

A. Shall be performed in accordance with Section 02222 – Excavation, Backfill, and Compaction for Utilities, and supplemented herein below.

3.02 EARTH COMPACTION AND BACKFILL

A. Shall be performed in accordance with Section 02222 – Excavation, Backfill, and Compaction for Utilities. Any backfill settlement shall be properly filled and compacted.

3.03 PIPE BEDDING

A. Shall be placed in accordance with the details provided on the Construction Plans, unless indicated otherwise.

3.04 LAYING AND INSTALLING PIPE

A. The Contractor will inspect all pipe before it is laid and any section found damaged by handling or which is defective to a degree which will materially affect the function and service of the pipe shall be removed from the site and shall be replaced with new and undamaged products.
B. Proper facilities shall be provided for lowering sections of pipe into excavation such that neither the pipe nor the excavation will be damaged or disturbed.

C. Under no circumstances shall pipe be laid in water or on frozen ground, and no pipe shall be laid when trench conditions or weather are unsuitable for such work.

D. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.

E. Pipe shall be laid true to the grades indicated and shall rest upon the pipe bed for the full length of each section.

F. Where bell and spigot pipe is used, spaces for the pipe bells shall be dug in the pipe subgrade to accommodate the bells. These spaces shall be deep enough to insure that the bells do not bear the load of the pipe and they shall not be excessively wide in relation to the longitudinal direction of the trench.

G. When the pipes are laid, the barrel of each section of pipe shall be in contact with the quadrant-shaped bedding throughout its full length, exclusive of the bell, to support the entire load of the pipe.

H. Provide batterboards spaced not more than 26' apart along the trench for checking installation of pipe to insure proper slope and elevation. Laser beam method may be used for insuring proper slope and elevation.

I. Runs of pipe shall be laid with outside laps or grooved ends upgrade beginning at the lower end of the pipe line.

J. Pipe having its grade or joint disturbed after laying shall be taken up, cleaned, and relaid.

K. When pipes are protected by head walls or connected with drainage structures, the exposed ends of the pipe shall be placed or cut flush with the face of the structure. After the pipe is cut, the rough edges shall be smoothed up in an approved manner.

L. All pipe shall be laid so that markings are on top and the inner surfaces abut neatly, tightly, and smoothly.

M. At the end of each day's work, the upgrade end of pipe lines not terminating in a structure shall be plugged or capped. All pipe shall be inspected by the Contractor as herein specified prior to placement of backfill.
N. Concrete pipe shall be handled and installed in accordance with the recommendations of the American Concrete Pipe Association "Concrete Pipe Handbook," 1988.

3.05  **ORIFICE OPENING**

A. Orifice openings are specified within inlets located in rain gardens. Core drill specific diameter of opening at invert elevation indicated on the Drawings for specific structure as denoted on Storm Drain Structure Schedule.

B. Core-Drilled Method: Core-drill the required opening true to line and absolutely smooth cored surface.

3.06  **CONCRETE PIPE JOINTS**

A. All pipe joints shall be sufficiently tight to prevent the migration of earth backfill through the pipe joint. All pipe joints shall be wrapped with filter fabric. Joints shall be constructed as described herein with the intent that they be made watertight.

B. For RCP, the joint surface shall be cleaned and washed with water, if necessary, before the joints are made. For tongue and groove joints in smaller sizes, butting the inside of the bell with a cement mortar before joining shall make the joints. The inside joint can be wiped clean of excess mortar by brush of a squeegee drawn through the pipe as the laying operations progress. In the larger diameters, which permit the entry of a man, an annular space is provided between pipe sections which shall be completely filled.

3.07  **MASTIC SEALANT**

A. Shall be installed in accordance with the printed recommendations of the manufacturer of the joint material. The tongue or spigot end of the pipe shall be cleaned of all dirt and shall be dry. The Mastic material shall be wrapped around the tongue or spigot overlapping at the ends. Mastic shall be pressed onto the pipe to avoid slippage of the mastic material during pipe handling. As the tongue or spigot end is inserted into the bell or groove, care shall be taken to ensure proper seating of the sealant to produce a tight seal and to fill all voids. A sufficient amount of sealant shall be used to fill the annular joint space with some squeeze out around the entire joint.

3.08  **CONNECTIONS**

A. Where connections to existing or proposed structures are indicated, these connections shall be watertight and made so that a smooth uniform flow
line will be obtained throughout the drainage system. All interior surfaces of the structure shall be ground smooth.

3.09 CONCRETE MANHOLES AND STRUCTURES

A. Shall be laid straight and plumb. Concrete pre-cast and cast-in-place bases shall have smooth inverts accurately shaped to a semi-circular bottom in accordance with the inside contour of the adjacent sewer sections.

B. Changes in direction of the sewer and entering branches into the manhole shall have a circular curve in the manhole invert of as large a radius as the size of the manhole will permit.

C. Pre-cast manholes and structures shall be provided with a 12" layer of gravel bedding under the concrete bases of the manholes.

D. Gaskets between manhole sections shall be installed in accordance with manufacturer's instructions.

E. Where inlet grates are installed, they shall be installed at the elevation indicated. Manholes covers shall be installed flush with all paved areas and sidewalks 1" above finished grade in unpaved areas.

F. Following installation of manhole and covers, all interior surfaces at joint, lifting holes, and brickwork shall be grouted smooth and watertight.

3.10 BRICKWORK

A. Joints in walls other than circular shall be laid in stretcher courses and every fifth course shall be a header course with full close joints. All mortar shall be used within 30 minutes of mixing.

B. Lay the brick in full mortar beds with shoved joints. Horizontal joints shall not exceed 1/2" and vertical joints shall not exceed 1/4" on the interior face.

C. All joints on the interior shall be struck flush with the masonry. The brickwork shall be corbelled as required.

3.11 INSPECTION AND TESTING

A. General

1. Storm sewer systems and culverts, upon completion or at such time as directed, shall be cleaned, inspected and tested. The system or culvert shall have a true grade and line. Actual elevations shall be within 0.08 feet of the elevations given on the construction drawings.
2. After completion of the Work, or any part thereof, the job shall be tested to determine that it has been installed in accordance with the construction drawings and specifications. In general, the Work shall prove to be in good condition, installed in accordance with the construction drawings and specifications and ready for use.

B. Cleaning and Testing

1. The contractor is to visibly inspect and remove all debris and obstructions from storm pipe. All storm pipe is to be tested for infiltration and exfiltration by hydrostatic testing per ASTM C969. All manholes and pipe shall meet ASTM C969 leakage criteria.

C. Alignment Test

1. After backfill has been placed and compacted to a depth not less than one foot above the top of pipe, a visual inspection shall be made by flashing a light between manholes. Any displacement or misalignment of invert shall be corrected.

D. Following the testing and inspection of the storm system, all necessary corrections shall be made using a method approved by the SEPTA Project Manager. Following corrections, the pipe shall be retested until the pipe is determined to meet Contract Specifications. All repairs and retesting shall be made at no additional costs to SEPTA. The Contractor shall notify the SEPTA Project Manager at least 48 hours prior to conducting such tests. The Contractor shall furnish the SEPTA Project Manager with written certification that all specified tests have been conducted and that the results thereof are in accordance with these specifications.

3.12 MEASUREMENT AND PAYMENT

A. There is no direct payment for work associated with storm drainage as described herein. Payment is included under the Lump Sum Price.
SECTION 02725
SANITARY FORCE MAINS

PART 1  GENERAL

1.01  SUMMARY

A. Section Includes: The work specified in this Section consists of constructing the piped wastewater force mains and appurtenances.

B. Related Sections:
   1. Section 02222 – Excavation, Backfill, and Compaction for Utilities.
   2. Section 03300 – Cast-In-Place Concrete.
   3. Section 03600 – Grout.

1.02  REFERENCES

A. American National Standards Institute (ANSI)/ American Water Works Association (AWWA):
   1. ANSI/AWWA C901-08 Polyethylene (PE) Pressure Pipe and Tubing, ½ in. Through 3 in. for Water Service.
   2. ANSI/AWWA C651 Standard for Disinfecting Water Mains.

B. ASTM International (ASTM):
   1. ASTM D2683 Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.


C. Plastic Pipe Institute (PPI):

1. Handbook of Polyethylene Pipe.

1.03 SUBMITTALS

A. Shop Drawings and Product Data: Submit completely dimensioned shop drawings, catalog cuts and such other data as required to provide complete descriptive information for the following:

1. Force Main Pipe and Fittings.

2. Piping Specialties.


B. Certificates: Submit certified records or reports of results of shop tests, with such records or reports containing a sworn statement that shop tests have been made as specified.

1. Sworn certifications shall bear the seal of a Registered Professional Engineer.

2. Provide manufacturer’s sworn certification stating that the pipe will be manufactured in accordance with specified reference standards for each pipe type.

1.04 QUALITY ASSURANCE

A. Design Criteria:

1. Use only one type and class of pipe in any continuous force main between structures, unless otherwise indicated on the Drawings.

2. Use pipe and fittings designed to withstand imposed trench loadings and prevailing site conditions at the various locations.
B. Source Quality Control:

1. Shop Tests: As a condition of the Contract, factory test pipe materials listed in the following table shall have been performed. Each pipe manufacturer shall have facilities to perform listed tests. The SEPTA Project Manager reserves the right to require the manufacturer to perform such additional number of tests as the SEPTA Project Manager may deem necessary to establish the quality of the material offered for use.

<table>
<thead>
<tr>
<th>PIPE DIMENSION RATIO (DR)</th>
<th>PRESSURE CLASS/ PRESSURE RATING</th>
<th>ALLOWABLE TOTAL PRESSURE DURING OCCASIONAL SURGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR 9</td>
<td>250 psi</td>
<td>500 psi</td>
</tr>
<tr>
<td>DR 11</td>
<td>200 psi</td>
<td>400 psi</td>
</tr>
<tr>
<td>DR 14.3</td>
<td>150 psi</td>
<td>300 psi</td>
</tr>
<tr>
<td>DR 17</td>
<td>125 psi</td>
<td>250 psi</td>
</tr>
</tbody>
</table>

2. Laboratory Tests: The SEPTA Project Manager reserves the right to require that laboratory tests also be conducted on materials that are shop tested. Furnish without compensation, labor, materials, and equipment necessary for collecting, packaging, and identifying representative samples of materials to be tested and the shipping of such samples to the Testing Laboratory.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Transport and handle products specified herein in a manner recommended by the respective manufacturers of such to prevent damage and defects.

B. Storage: Store Products in accordance with manufacturer's recommendations to avoid shock or prevent physical damage and defects.

C. Do not use chains, wire rope, forklifts or other methods or equipment that may gouge or damage the pipe.

D. If any gouges, scrapes, or other damage to the pipe results in loss of 10% of the pipe wall thickness, cut out that section or do not use.

1.06 SITE CONDITIONS

A. Environmental Requirements:
1. Keep trenches dewatered until pipe joints have been made and concrete cradle and encasement, if any, have cured.

2. Under no circumstances lay pipe in water or on bedding containing frost.

3. Do not lay pipe when weather conditions are unsuitable for pipe laying work, as determined by the SEPTA Project Manager.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Polyethylene Pipe:

1. Polyethylene pipe shall be made from a HDPE material having a minimum material designation code of PE 4710 or PE 3608. The material shall meet the requirements of ASTM D3350 and shall have a minimum call classification of PE445474C for PE 4710 and PE345464 for PE 3608. In addition, the pipe shall be listed as meeting NSF-61.

2. The pipe shall meet the requirements of AWWA C901.

3. HDPE pipe shall be rated for use at a pressure class of 250 psi. The outside diameter of the pipe shall be based upon the SIDR rating system.

2.02 FITTINGS

A. Butt Fusion Fittings:

1. Fittings shall be made of either PE4710 or PE3608, with a minimum Cell Classification as noted in 2.01 A. Butt Fusion Fittings shall meet the requirements of ASTM D3261. Molded and fabricated fittings shall have a pressure rating equal to the pipe unless otherwise specified in the plans.

2. Markings for molded fittings shall comply with the requirements of ASTM D3261. Fabricated fittings shall be marked in accordance with ASTM F2206. Socket fittings shall meet ASTM D2683.

B. Electrofusion Fittings:

1. Fittings shall be PE4710 or PE3608, with a minimum Cell Classification as noted in 2.01 A. Electrofusion Fittings shall have a manufacturing standard of ASTM F1055. Fittings shall have a
pressure rating equal to the pipe unless otherwise specified on the plans.

C. Flanges and Mechanical Joint Adapters (MJ Adapters):
   1. Flanges and Mechanical Joint Adapters shall be PE4710 or PE3608, with a minimum Cell Classification as noted in 2.01 A. Flanged and Mechanical Joint Adapters can be made to ASTM D3261 or if machined, must meet the requirements of ASTM F2206. Flanges and MJ Adapters shall have a pressure rating equal to the pipe unless otherwise specified on the plans. Marking for molded or machined flanged adapters shall be per ASTM D3261. Fabricated (including machined) flange adapters shall be per ASTM F2206.

D. Service connections shall be electrofusion saddles with a brass or stainless steel threaded outlet, electrofusion saddles, sidewall fusion branch saddles, tapping tees, or mechanical saddles.

E. For electrofusion saddles with threaded outlet, the size of the outlet shall be one inch IPS unless a larger size is shown on the plans. Electrofusion saddles shall be made from materials required in part 1.02 B.

F. For sidewall fusion saddles, the size of the saddle shall be as indicated on the plans. The saddle can be made in accordance to ASTM D3261 or ASTM F2206. After installation, approximately ¼” of the PE pipe shall be visible beyond the saddle to confirm that proper surface preparation occurred. Saddle faces that do not provide ¼ inch of area beyond the saddle are not acceptable.

G. Tapping tees shall be made to ASTM D3261 or ASTM D2683.

H. Mechanical strap-on saddles can only be used where their use on PE pipe is approved by the mechanical saddle manufacturer. The body of the saddle shall be stainless steel, epoxy coated cast iron or brass. The gasket material and design must be acceptable for PE pipe. The outlet shall be threaded for one inch IPS unless a larger size is shown on the plans. Mechanical strap-on saddles will be installed per the manufacturer’s instructions.

2.03 PIPE AND FITTING IDENTIFICATION

A. The pipe shall be marked in accordance with the standards to which it is manufactured.

B. Tracing wire shall be placed parallel and above, but separate from the pipe.
C. Marking tape shall be approved by the SEPTA Project Manager and placed 6 to 12 inches above the crown of the pipe.

PART 3 EXECUTION

3.01 EXAMINATION

A. Field Inspection: Inspect each section of pipe and each pipe fitting before laying in conformance with the inspection requirements of the appropriate referenced standard.

B. Rejected Products: Remove rejected Products from the Project site and replace with new Products at no increase in Contract Price.

1. Pipe already laid and later found defective will not be accepted and shall require replacement at no increase in Contract Price.

3.02 PREPARATION

A. General Requirements: Clean piping interior prior to laying pipe and following pipe laying, and keep open ends of piping and pipe attachment openings capped or plugged until actual connection or actual pipe testing.

1. Provide the protective means to prevent water and debris from washing into the pipe.

B. Earthwork: Perform earthwork for force main installation as specified in Section 02220.

1. Bedding materials and concrete work for pipe bedding as specified in Section 02222.

2. Excavate trenches at least 25 feet in advance of pipe laying. Protect pipe ends from trenching operations.

3.03 CONSTRUCTION

A. General Requirements: Use proper and suitable tools and appliances for the proper and safe handling, lowering into trench and laying of pipes.

1. Lay pipe proceeding upgrade true to line and grades given. Lay bell and spigot pipe with bell end upgrade. No wedging or blocking permitted in laying pipe unless by written order of SEPTA Project Manager.

2. Unless indicated otherwise, piping shall be installed with not less than 4 feet of cover.
3. Exercise care to insure that each length abuts against the next in such manner that no shoulder or unevenness of any kind occurs along inside bottom half of pipe line.

4. Before joints are made, bed each section of pipe full length of barrel with recesses excavated so pipe invert forms continuous grade with invert of pipe previously laid. Do not bring succeeding pipe into position until the preceding length is embedded and securely in place. Dig bell holes sufficiently large to permit proper joint making and to insure pipe is firmly bedded full length of its barrel.

5. Walking or working on the installed force main, except as necessary in tamping and backfilling, not permitted until trench is backfilled 1-foot deep over top of pipes.

6. Take up and relay pipe that is out of alignment or grade, or pipe having disturbed joints after laying.

B. Pipe Laying and Joining: Perform pipe laying and joining in strict accordance with manufacturer's installation instructions, reference standards as included, and such additional requirements as specified herein.

1. Arrange and pay for pipe manufacturer's representative to be present for first installation of pipe to instruct workmen on proper installation methods.

2. Make joints absolutely watertight and immediately repair detected leaks and defects. Methods of repair subject to SEPTA project Manager's approval.

C. Connections of Piping to Existing Manholes or Structures: The option is allowed to construct pipe connections to existing manholes or structures by one of the methods stated herein, except where indicated otherwise on the Drawings. A mixture of connection methods is not allowed.

1. Core-drilled Opening Utilizing Sleeve Type Pipe Seal: Core-drill the required opening or openings using the proper equipment for the work. Make openings of sufficient size to accommodate the Pipe Seal.

2. Core-drilled Opening Utilizing Modular, Mechanical Type Pipe Seal: Core-drill the required opening or openings using the proper equipment for the work. Make openings of sufficient size to accommodate the Pipe Seal.

3. New Invert Channel: Regardless of the connection to existing manhole option selected, form a new invert channel in the existing
manhole base to properly conduct the flow through the existing manhole. Do not permit ground water, surface water, or debris to enter the existing facilities through the new connection.

4. Drop Connections: Make drop connections as indicated on the Drawings, where drop in invert is 0.61M [2 feet] or more or as required by the Contracting Officer.

D. Inserting Valve Installation: Perform installation of the valves in accordance with the installation instructions/training by and under the direct supervision of the valve manufacturer's field supervisor.

1. Preparation: Perform the required preparatory work prior to the arrival of the field supervisor, including the necessary excavation, excavation support work, valve foundation work, pipeline stabilizing and bracing work, and providing on-site the equipment and machinery required to place the valve and parts, and to operate the inserting machine.

2. Installation: The Contractor's crew shall perform the valve installation with the valve manufacturer's field supervisor providing "hands-on" guidance on how to assemble the valve and how to operate the inserting equipment. Nothing contained in these Contract Documents shall imply the valve manufacturer's field supervisor as being party to this Contract.

E. Setting Valves and Boxes:

1. Unless otherwise directed by the Contracting Officer, set valves and boxes truly vertical.

2. Set valve and boxes neatly to grade and in such a way that the box does not transfer shock or stress to the valve. Exercise care to center the box over the wrench nut of the valve.

3.04 FIELD QUALITY CONTROL

A. General Requirements: Conduct tests specified herein so that each force main installed in the Project is tested to the SEPTA Project Manager’s satisfaction.

1. The Contractor may elect to make a leakage test prior to backfilling the trenches, for its own purposes. However, the leakage tests of the force mains or sections thereof for acceptance shall be conducted after the backfilling of the trenches has been completed.

2. Provide tools, materials (including water), apparatus, and instruments necessary for force main testing.
3. When the length of the force main exceeds 1000 feet, test the force main in sections, the length of each section to be determined by the SEPTA Project Manager.

4. Conduct tests of every kind in the presence of and to the satisfaction of the SEPTA project Manager.

B. Testing Equipment: Use testing apparatus equipped with a control panel with necessary piping, control valves, and gauges to control pressures within the piping test section, and to monitor pressures throughout the test.

1. To prevent accidental overloading of piping test section, provide testing apparatus with an approved pressure relief device set to relieve at 80 psig.

2. Provide an extra pressure gauge of known accuracy to frequently check test equipment and apparatus.

3. Testing equipment and associated testing apparatus subject to SEPTA Project Manager’s approval.

C. Cleaning Prior to Tests: Before tests are conducted, flush piping with clean water until free of all forms of dirt and construction debris.

1. The water for the flush cleaning operation shall be from the Contractor's source.

D. Line Acceptance Test: After a force main or section thereof is constructed, backfilled, and successfully cleaned, perform a hydrostatic Line Acceptance Test as follows:

1. Hydrostatic leakage testing is recommended and shall comply with ASTM F2164, ASTM F1412, AWWA Manual of Practice M55 Chapter 9 and PPI Handbook of Polyethylene Pipe.

2. If the test section fails this test, the Contractor shall repair or replace all defective materials and/or workmanship at no additional cost to SEPTA.

3. Pneumatic (compressed air) leakage test of HDPE pressure piping is prohibited for safety reasons.

E. Repair and Retest: When force main or sections of force main fails to meet test requirements specified previously, determine source or sources of leakage and repair or replace defective material, and if a result of improper workmanship, correct such.
1. Conduct such additional tests required to demonstrate that force main meets specified test requirements.

END OF SECTION
SECTION 02821
CHAIN LINK FENCES AND GATES

PART 1  GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for chain link fence and gate components.

B. Related Sections:

1. Section 03300: Cast-In-Place Concrete.

1.02 REFERENCES

A. ASTM International (ASTM):


2. ASTM F567; Standard Practice for Installation of Chain-Link Fence.


4. ASTM F668, Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric.


1.03 SYSTEM DESCRIPTION

A. Design Requirements: Black Vinyl Coated Chain link type with top and bottom rail. Fabric height to be four feet (4’).

1.04 SUBMITTALS

A. Shop Drawings and Product Data: Manufacturer's published details modified to suit design and field conditions. Manufacturer's descriptive literature and specifications covering products specified. Include installation information.

B. Certificates: Include in Submittals certified mill certificates indicating material conformity to yield strengths of these Specifications.
1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Continuing member of Chain Link Fence Manufacturer Institute (CLFMI).

B. Erector Qualifications: Provide at least one person in a supervisory capacity, who is skilled and experienced in erecting chain link fence, readily understands proposed layout and is completely familiar with current erection practices of CLFMI. Said person shall be present during progress of fence installation.

C. Product Compatibility: Chain link fence components to be products of one manufacturer.

PART 2 PRODUCTS

2.01 FRAME MATERIALS

A. Framing Members: Type A steel pipe (schedule 40) per ASTM F1083 having minimum yield strength of 30,000 psi. Pipe coated inside and outside by hot dipped method with minimum zinc coating of 1.8-oz/square foot.

1. Intermediate (Line) Posts: Nominal 2-1/2 inch roll formed shapes or tubular members fabricated weighing 3.65 lbs. per ft.

2. End, Pull, and Corner Posts: Nominal 3 inch roll formed shapes or tubular members and weighing 5.79 lbs. per ft.

3. Post Braces: Nominal l-5/8 inch steel pipe weighing 2.27 lbs. per ft. minimum, with 3/8-inch diameter truss rod and adjustable take-up device. Provide two brace assemblies at each corner post and one brace assembly at each end and gatepost.

4. Top Rail: Nominal 1 5/8-inch steel pipe weighing 2.27 lbs. per ft. minimum.

5. Bottom Rail: Nominal 1 5/8-inch steel pipe weighing 2.27 lbs. per ft. minimum.

B. Framing Accessories: In general, conforming to ASTM F626, stretcher bars, stretcher bar bands, post tops, with zinc hot-galvanized coating.

1. Post Tops: Cover post ends with pressed steel or malleable iron, weather tight caps designed to permit passage of top rail, as required.
2. Stretcher Bars: One-piece $\frac{3}{16} \times \frac{3}{4}$-inch bar, aluminum or galvanized steel, of length equal to full height of fabric. Provide one bar for each gate and end post and two for each corner and pull post. Provide $\frac{1}{2}$-inch wide stretcher bar bands spaced not over 15 inches o.c. to secure stretcher bars to posts.


4. Concrete: Per requirements of Cast-In-Place Concrete: Section 03300.

2.02 FABRIC AND WIRE

A. Vinyl Coated Fabric: ASTM F668, Class 2b, thermally fused and bonded PVC coated over galvanized steel No. 9 gauge wire having a .006 inch minimum coating thickness. Wire zinc coating shall be 0.30 ounces / square foot minimum.


2. Mesh Size and Style: Fabric interwoven in a two-inch mesh with top knuckled selvage and bottom twisted selvage. Cut ends of wires coated with vinyl at the factory during the weaving process.

B. Tension Wire and Tie Wires:


2. Tie Wires: Tie wire for fabric to line posts, rails, and braces; minimum 9 gauge and have the same wire and coating as tension wire.

2.03 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.

2. Material on or below Finished Grade: Copper.

3. Bonding Jumpers: Braided copper tape, 1” wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.
1. Connectors for Below-Grade Use: Exothermic welded type.

2. Grounding Rods: Copper-clad steel.
   a. Size: % by 96 inches.

**PART 3 EXECUTION**

**3.01 INSTALLATION**

A. Install chain link fence in accordance with ASTM F567.

B. Do not begin prior to completion of site grading operations.

C. Drill holes for post footings in firm, undisturbed or compacted soil to a diameter equal to 4 times diameter of post. Excavate hole depths approximately 4 inches deeper than post bottom, with bottom of posts set not less than 36 inches in concrete base. Maximum spacing for posts is 10 feet on center.

D. Place concrete around posts in a continuous pour. Tamp for consolidation. Check each post for vertical and top alignment. Crown top of post footings to shed water or as detailed.

E. Set keepers, stops, sleeves, and other accessories into concrete.

F. Install braces so posts are plumb when diagonal rods are under proper tension.

G. Install tension wires before stretching fabric and tie to each post with ties or clips.

H. Pull fabric taut and tie to braces, rails, and tension wires with wire ties spaced not over 24 inches o.c. Leave approximately 2 inches between finished grade and bottom selvage. Install fabric on security side of fence, and anchor to framework so that fabric remains in tensions after pulling force is released.

I. Thread stretcher bars through fabric, and secure to posts with metal bands spaced not over 15 inches o.c.

J. Install ground set items in concrete for anchorage, as recommended by fence manufacturer and as detailed. Adjust hardware for smooth operation and lubricate where necessary.

K. Install gates plumb, level and secure for full opening without interference. Install ground set items in concrete for anchorage, as recommended by
fence manufacturer and as detailed. Adjust hardware for smooth operation and lubricate where necessary.

3.02 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 feet of buildings, structures, walkways, and roadways: Ground at maximum intervals of 750 feet.
   a. Gates and other fence openings: Ground fence on each side of opening.
      1) Bond metal gates to gate posts.
      2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at crossings of overhead electrical power lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Grounding method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.

D. Bonding method for gates: Connect bonding jumper between gate post and gate frame.

E. Connections: Make connections so possibility of galvanic action of electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.


5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.03 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Engage a qualified independent testing and inspecting agency to perform field quality-control testing.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

2. Excessive grounding resistance: If resistance to grounding exceeds specified value, notify Owner promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.

3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

END OF SECTION
SECTION 02822
ORNAMENTAL FENCING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Requirements for ornamental fencing.

B. Related Sections:

1. Section 03300: Cast-In-Place Concrete.

1.02 REFERENCES

A. ASTM International (ASTM):

1. ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.


1.03 SYSTEM DESCRIPTION

A. Design Requirements: Black, Steel Ornamental Picket Fence with top, bottom, and accent horizontals rails. Fence height to be four feet (4’).

1.04 SUBMITTALS

A. Shop Drawings and Product Data: Manufacturer’s published details modified to suit design and field conditions. Manufacturer’s descriptive literature and specifications covering products specified. Include installation information.

B. Certificates: Include in Submittals certified mill certificates indicating material conformity to yield strengths of these Specifications.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specialized in manufacturing products specified in this section.

B. Erector Qualifications: Provide at least one person in a supervisory capacity, who is skilled and experienced in erecting ornamental fence, readily understands proposed layout and is completely familiar with erection practices. Said person to be present during progress of fence installation.

C. Product Compatibility: Entire fence system components to be products of one manufacturer.

PART 2 PRODUCTS

2.01 ORNAMENTAL FENCE

A. Steel Ornamental Fence – Fusion Welded: System includes posts, panels, and mounting accessories.

1. Grade – Commercial.

2. Standard Style: 3 \(\frac{11}{16}\) inch air space between pickets.

3. Flush top rail, bottom rail, and accent rail.

4. Flat post pickets extend above top rail.

5. Steel (ASTM A924): Steel for tubular pickets, rails, and posts shall have a minimum yield strength of 45,000 psi.
6. Galvanizing (ASTM A653): Prior to forming, hot-dip galvanized with minimum zinc coating weight of 0.60 oz/ft², Coating Designation G-60.

7. Rails
   a. Steel Channel, 1.4375 inches x 1.5 inches.
   b. Standard Picket Spacing: Picket holes shall be spaced at 4.675 inches o.c.

8. Pickets: ¾ inches square x 17 gauge tubing.

9. Racking/Biasability (Ability of Panels to Follow Grades) able to follow varying grade changes to a maximum of 48-inch rise in an 8-foot run.

10. Posts: Size 2.5 inches x 2.5 inches by 16 gauge with standard post cap.

2.02 FINISH

A. Polyester Coating: Thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including six-stage pretreatment/wash with zinc phosphate and a separate electrostatic spray application of a polyester top coat finish.

1. Top Coat Coating Thickness: No-mar TGIC polyester powder finish with minimum thickness of 2 to 4 mils.

2. Coating Performance Requirements: Coating meets or exceeds the following:
   b. Corrosion Resistance (ASTM B117, ASTM D1654): Coated galvanized steel shall be capable of salt spray resistance for 1,000 hours without loss of adhesion on parts scribed per ASTM D1654 and tested in accordance with ASTM B117. Failure is considered to have occurred when there is either 1/8 inch coating loss from the scribed mark or an accumulation of medium #8 blisters.
   c. Impact Resistance (ASTM D2794): 60 inch pounds, minimum (impact using 0.625 inch ball).
d. Weathering Resistance (ASTM D822, ASTM D2244, ASTM D523 – 60 Degree Method): 1,000 hours minimum (failure mode is 60 percent loss of gloss or color variance of more than 3 delta-E color units).

2.03 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
   1. Material above Finished Grade: Copper.
   2. Material on or below Finished Grade: Copper.
   3. Bonding Jumpers: Braided copper tape, 1” wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.
   1. Connectors for Below-Grade Use: Exothermic welded type.
   2. Grounding Rods: Copper-clad steel.
      a. Size: % by 96 inches.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install ornamental fence in accordance with manufacturer’s instructions.

B. Do not begin prior to completion of site grading operations.

C. Drill holes for post footings in firm, undisturbed or compacted soil to a diameter equal to 4 times diameter of post. Excavate hole depths approximately 4 inches deeper than post bottom, with bottom of posts set not less than 36 inches in concrete base. Fence posts shall be set in accordance with the manufacturer’s recommended spacing.

D. Place concrete around posts in a continuous pour. Tamp for consolidation. Check each post for vertical and top alignment. Crown top of post footings to shed water or as detailed.

E. Set keepers, stops, sleeves and other accessories into concrete.

F. Install braces so posts are plumb when diagonal rods are under proper tension.
G. Panels shall be attached to posts using mechanically fastened panel brackets supplied by the manufacturer.

H. When cutting rails immediately seal the exposed surfaces with zinc-rich primer and apply two coats of custom finish spray paint matching fence color.

I. Install ground set items in concrete for anchorage, as recommended by fence manufacturer and as detailed. Adjust hardware for smooth operation and lubricate where necessary.

3.02 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 feet of buildings, structures, walkways, and roadways: Ground at maximum intervals of 750 feet.

a. Gates and other fence openings: Ground fence on each side of opening.

   1) Bond metal gates to gate posts.

   2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at crossings of overhead electrical power lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Grounding method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.

D. Connections: Make connections so possibility of galvanic action of electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

   1. Use electroplated or hot tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

   2. Make connections with clean, bare metal at points of contact.


5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.03 FIELD QUALITY CONTROL

A. Grounding-Resistance Testing: Engage a qualified independent testing and inspecting agency to perform field quality-control testing.

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

2. Excessive grounding resistance: If resistance to grounding exceeds specified value, notify SEPTA Project Manager promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.

3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

END OF SECTION
SECTION 02841
SECURITY BOLLARDS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. Crash-Certified, Impact Certified, High Security Fixed and Removable Bollards, including engineering design work as necessary to certify Bollard installation as K4 – Fixed.

1.02 SUBMITTALS

A. Product Data: For Crash Tested Security Bollards that are certified by the United States Department of State: Full documentation showing compliance with DOD requirements for K4 Security Bollards including full scale test data, independent verification, structural design calculations, and list of similar projects. Supply style and color data for Security Bollard Covers.

B. Shop Drawings: Include plans, elevations, sections, details of installation, reinforcing, and attachments to other Work resulting in a complete installation compliant with the performance standards set forth in this Section.

C. Calculations: Include calculations for the analysis and design of the K4 (Fixed) Security Bollards including the impact of the Security Bollards on existing subgrade and suspended slab system. Calculations shall be sealed by a Registered Professional Engineer.

D. Samples: Color and Type for Ornamental Decorative Bollard Covers.

1.03 RELATED REQUIREMENTS

A. Section 03200 – Concrete Reinforcement.

B. Section 03300 – Cast in Place Concrete.

1.04 REFERENCES

A. ASTM International (ASTM):


10. ASTM A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

11. ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.


14. ASTM A793, Standard Specification for Rolled Floor Plate, Stainless Steel


1.05 PERFORMANCE REQUIREMENTS

A. K4 Security Bollards (Fixed): Security Bollards that are certified by the DOS and/or DoD to have a performance of K4: Bollard design shall have successfully passed actual full scale crash tests conducted by a qualified
independent agency acceptable to the certifying authority (have passed the physical crash test with a single bollard being impacted).

B. Security Bollards shall be designed to suit site layout. The design of the bollards shall allow for the following minimum features for site installation:

1. The design should be modular to facilitate fast and easy installation.

2. The bollards shall be fully fabricated off site and no ‘hot work’ shall be required during the installation.

C. Security Bollard system to be ADA compliant at cross walks as applicable.

1.06 QUALITY CONTROL

A. Pre-installation Conference: Before beginning installation of Bollard system, conduct conference at Project site to comply with the requirements in Division 1 Section “Project Meetings.”

1. Engineer shall be present at the conference. The Contractor shall notify the Engineer at least 10 days prior to the scheduled date of the conference.

2. Minutes of the conference shall be recorded, typed and printed by the Contractor and distributed by him to all parties.

3. Agenda: Includes but is not limited to:

   a. Submittals.

   b. Construction schedule, coordination, traffic planning, contractor work area.

   c. Coordination of Work and availability of material.

   d. Steel Reinforcement Installation (if required).

   e. Concrete Mix Design including admixtures.

   f. Methods of placing, finishing, and curing.

   g. Cold Weather and Hot Weather Procedure.

   h. Field Quality Control Inspections.

   i. Tolerance on installed items.
1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in the fabricating of Security Bollard Type vehicle barriers in field operation.

1. Manufacturer assumes full responsibility for engineering of bollard system to comply with performance standards. This responsibility includes the preparation of Shop Drawings and comprehensive engineering analysis by a licensed professional engineer.

2. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for fabrication, installation and certification of security bollards that are of a kind equivalent to those indicated for this Project in material, design and extent.

3. The Security Bollard System shall be the type supplied and installed at major infrastructure sites. The manufacturer shall have at least 10 similar systems installed and in operation with documented logs of all major components and design features.

4. Warranty: The system will carry a full 12-month parts and labor warranty.

5. A Factory Acceptance Test Report will be issued to the Owner at the completion of the fabrication process prior to installation to verify manufacture quality.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Ameristar, 1555 North Mingo Road, Tulsa, OK 74116; 1-888-333-3422, www.ameristarfence.com


3. NEU Security Services (NSS), 8206 Cross Park Drive, Suite 300, Austin Texas 78754; (512) 469-9980, www.neusecurity.com

4. Concentric Security, 7560 Main Street, Sykesville, MD 21784; (800) 854-0050, www.concentricsecurity.com
5. Delta Scientific, 40355 Delta Lane, Palmdale, CA 93551; (661) 575-1100, www.deltascientific.com

6. RSA Protective Technologies, 1573 Mimosa Court, Upland, CA 91784; (909) 946-0964, www.rsaprotect.com

2.02 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Ferrous Metals:

1. Steel Plates, Shapes, and Bars: ASTM A36.

2. Stainless-Steel Bars and Shapes: ASTM A276, Type 304.

3. Rolled-Steel Floor Plate: ASTM A786, rolled from plate complying with ASTM A36, or ASTM A283, Grade C or D.

4. Rolled-Stainless-Steel Floor Plate: ASTM A793.

5. Steel Tubing: Cold-formed steel tubing complying with ASTM A500.

6. Steel Pipe: ASTM A53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

7. Galvanizing: ASTM A653, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating; 0.079-inch (2-mm) nominal thickness.


9. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either ASTM A47 (ASTM A47M) malleable iron or ASTM A27 cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A153.

2.03 PAINT

A. Shop Primer for Ferrous Metal: SSPC-Paint 20, organic zinc-rich primer compatible with topcoat.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

   a. Carboline Company; Carboline 621.

B. Galvanizing Repair Paint: SSPC-Paint 20, high-zinc-dust-content paint for regalvanizing welds in steel.

2.04 MISCELLANEOUS MATERIALS

A. Fasteners: Type 304 or 316 stainless-steel fasteners for exterior use and zinc- fasteners with coating complying with ASTM B633, Class Fe/Zn 5, where built into exterior walls, of type, grade, and class required by application indicated.

B. Nonshrink, Nonmetallic Grout: ASTM C1107, factory-packaged, nonstaining, noncorrosive, nongaseous grout.

C. Concrete Fill: Comply with manufacturers certified design requirements and Section 03300 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 4000 psi whichever is more strict.

2.05 FABRICATION

A. Connections, General: Use connections that maintain structural value of joined pieces.

1. Shear and punch metals cleanly and accurately. Remove burrs.

2. Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish exposed welds smooth and blended.

3. Fabricate joints that will be exposed to weather in a manner to exclude water or provide weep holes.

4. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Locate joints where least conspicuous.

2.06 FINISHES

A. Finish metal fabrications after assembly. Comply with NAAMM’s "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Shop prime ferrous-metal items not indicated to be galvanized.
1. Hot-dip galvanize items indicated to be galvanized to comply with ASTM A123 or ASTM A153 as applicable.

2. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, “Power Tool Cleaning.”

B. Bollard Covers (Decorative sleeve). Color and Style as selected by SEPTA.

PART 3 EXECUTION

3.01 INSTALLATION

A. General: Provide anchorage devices and fasteners for securing metal fabrications to in-place construction. Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location with edges and surfaces level, plumb, and true.

1. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or similar construction.

2. Fit exposed connections accurately together. Do not weld, cut, or abrade galvanized surfaces.

B. Security Bollards:

1. Anchor in concrete in accordance with manufacturer’s system design.

2. Anchor in place with concrete footings. Support and brace bollards in position in footing excavations until concrete has been placed and cured.

C. Testing

1. Upon completion of the Security Bollard System fabrication, the system will be fully quality checked at manufacturer’s facility. A Factory Acceptance Test Report will be prepared to verify manufacture quality.

D. Touch up surfaces and finishes after erection.

1. Painted Surfaces: Clean field welds, bolted connections, and abraded areas and touch up paint with the same material as used for shop painting.

2. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780.
END OF SECTION
SECTION 02842
SITE SIGNAGE

PART 1  GENERAL

1.01  DESCRIPTION

A. Provide all material, equipment, and labor to furnish and install station signage in accordance to SEPTA Standard Manual and as indicated on the contract drawings and as specified herein. All signage must be approved by SEPTA Graphics PRIOR TO fabrication. Types of signage include the following:

1. Reflective full color digital print on pressure sensitive vinyl film with continuous clear matte laminate over entire sign face.

2. Graphics for sign panels and sign plaques.

3. Metal signage and associated fastenings.


B. Signwork under this Section includes furnishing and installing on-site station signs, with posts, clamps, accessories and concrete bases for work as indicated on the Contract Drawings and as specified herein.

1.02  RELATED SECTIONS

A. Division 1 - General Requirements.

B. Section 03300 - Cast-in-Place Concrete.

C. Section 05500 - Metal Fabrications.

D. Section 05520 - Handrails and Railings.

1.03  SUBMITTALS

A. Submit the following in accordance with Specification Section 01300:

1. Manufacturer's Literature: Submit manufacturer's technical product data, installation instructions, use limitations, and recommendation for each material product used. Provide certification that materials comply with requirements.

   a. Submit two (2) copies of each manufacturer’s recommendations for the maintenance of all items.
b. Submit two (2) copies of the cleaning, repair, repainting, and maintenance of all signs, including the data on cleaning solutions and methods of applications which should be avoided.

2. Shop Drawings: Submit shop drawings of all Work of this Section. Do not order materials or begin fabrication until SEPTA Project Manager's review has been obtained.

   a. Show sizes and thicknesses of all members, types of materials, methods of connection and assembly, complete dimensions, hangers, brackets, anchorage, relationship to surrounding Work by other trades, shop finishes, sign designs, layouts and lettering, and other pertinent details of fabrication and installation.

   b. Field Measurements: to the greatest extent possible, take accurate field measurements before preparation of shop drawings and fabrication.

   c. Provide plans, elevations, and details of anchorages, connections, and accessory items. Show all adjacent Work.

   d. Provide setting drawings, templates, and directions for installation of anchorage devices.

3. Samples: Submit two (2) of the full range of samples for each type of unit required, showing colors, textures, and finishes specified herein to the Engineer for selection and approval.

   a. Submit two (2) samples of all colors and finish proposed for use on signs, at least 6 inch square, on same substrate to be used in the Work.

   b. Submit (2) full size paper proofs of all signs, with proposed colors marked thereon.

   c. After approval of color match and lettering proofs, submit for SEPTA's approval one full-size sign of each type, as selected by the SEPTA Project Manager, complete in all respects and ready for installation. Submit as many times as necessary until SEPTA's approval has been obtained.

   d. Sample sign, upon approval, shall serve as a standard to be equaled for all other sign Work.

   e. Sample materials, fasteners, hardware mounting hardware sufficient to get a clear understanding how signs are fabricated, made changeable, and installed.
4. Schedule of Signs: Submit schedule of signs listing all signs to be fabricated:
   a. List signs in sets by their application at each station.
   b. For each set of signs, describe sign material, copy of sign, and mounting system for sign.

1.04 QUALITY ASSURANCE

A. Source: Provide materials which are products of a single manufacturer for each type of product or material required by this Section. Provide secondary or accessory materials which are acceptable to the manufacturers of the primary materials.

B. Coordination: Furnish inserts and anchoring devices which must be built into other Work. Coordinate delivery of inserts and anchors to trades performing the installation so as to avoid delay in the Work.

C. Mock-Ups: Prior to commencing the primary Work of this Section, provide full size mock-ups at locations acceptable to the SEPTA Project Manager. Obtain SEPTA Project Manager's acceptance of visual qualities. Protect and maintain accepted mock-ups throughout the remainder of the Work of this Section to serve as criteria for acceptance of the Work.

   1. Include a minimum of one full-size tactile sign mock-up.
   2. Include a minimum of one full-size aluminum sign mock-up.
   3. Include a minimum of one full-size steel sign mock-up.

D. All colors will be selected from the SEPTA signage manual.

E. All signage will comply with the latest edition of the SEPTA graphic standards for signage.

F. All signage shown in the Contract Documents and SEPTA Guidelines is subject to change by SEPTA.

1.05 QUALIFICATIONS

A. Installer Qualifications: An experienced installer who has signage installations experience similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver units cartoned or crated to provide protection during transit and job storage.

B. Inspect units upon delivery for damage. Minor damages may be repaired provided refinshed items are equal in all respects to new Work and acceptable to the SEPTA Project Manager; otherwise, remove and replace damaged items as directed.

C. Store units at building site under cover. Place units on minimum 4-inch-high wood blocking.

1. Avoid the use of non-ventilating type plastic or canvas shelters which could create humidity chambers. If packaging of units becomes wet, remove carton or crating immediately.

2. Provide 4-inch spaces between units to promote air circulation.

D. Completed sign panels shall be properly protected and maintained in good condition, free from dirt, scratches, handcarts or other blemishes. The panels shall be shipped in such manner as to insure their arrival on the job site in an undamaged condition.

E. Subsequent to erection, if directed by the SEPTA Project Manager, any exterior signs may be required to be covered until the actual use thereof is desired. Material used to temporarily cover any sign panel shall effectively conceal the message and be non-injurious to the panel, its finish, or its structural integrity.

1.07 WARRANTY

A. The work performed by the Contractor shall be guaranteed for the manufacturer’s standard period of time, from the date of Final Payment against defects in workmanship and materials. All defective work and material shall be replaced or repaired within 48 hours after notification to the satisfaction of SEPTA and without any additional cost during the guarantee period.

B. The contractor shall certify that all pictogram, tactile and Braille signage comply with the requirements of the ADA, the ADAAG and the International Building Code, latest revisions. The Contractor shall replace any signs deemed not to be in compliance at the time of substantial completion at no cost to SEPTA.
PART 2 PRODUCTS

2.01 MATERIALS (AND OR EQUIPMENT)

A. Acceptable Manufacturers: Provide tactile signs from one of the following manufacturers, or an approved equal:

2. AGI, Virginia Beach, VA.
3. APCO, Franklin, MA.
4. ASI Sign Industries, East Berlin, CT.
5. Or approved equal.

B. Schedule of signs

1. Refer to Drawings and Specifications for location, quantities, types, sizes, designs, and mounting devices, posts, and bases.
2. Coordinate and obtain approval from the SEPTA Project Manager, and SEPTA signage standards for all signs graphics to be used in this Contract.
3. All signs will comply with SEPTA signage standards, as determined by SEPTA Project Manager.

C. Tactile signs

1. Tactile signs shall be 1/8" thick aluminum sheet with no less than the strength and durability properties specified in ASTM B209 for 5005-H15, with copy photo-etched .039 inch from surface.
   a. Relief (positive) shall have brushed aluminum finish integral with aluminum plate. No applied graphics.
   b. Negative shall be manufacturer's baked enamel: black.
   c. Entire sign shall be coated with clear urethane protective coating.
2. Adhesive and Double Stick Tape: Use combination of adhesive and double-stick tape for attaching tactile signs to substrates. Double-stick tape holds the sign in position until the adhesive has cured. Provide products as follows:
a. Double-Stick Tape: Provide Double Coated Polyfoam Mounting Tape. Foam tape shall be .079 inch thick. Tape shall conform to the following:

1) Density: 6 pcf.
2) Adhesive: 4.5 mils.
3) Adhesion: Peel Shear; 76 + hrs @ 2 psi.
4) Tensile Strength: 6 lbs./1 "
5) Elongation: 300%

b. Sealant Adhesive: Provide 100% Silicone neutral cure, one component adhesive sealant, conforming to ASTM C920. Provide sealant equal to Dow Corning 832 Plant Maintenance Sealant.

3. Frames: Frames shall be heavy duty 12 gage brushed finish aluminum to dimensions and tolerances indicated on Drawings. Frames shall be anchored with fasteners that will be concealed by the finished sign.

D. Metal signs

1. Metal signs shall be 1/8" thick aluminum sheet with no less than the strength and durability properties specified in ASTM B209 for 5052-H32, with copy photo-etched .039 inch from surface.

   a. Relief (positive) shall have brushed aluminum finish integral with aluminum plate. No applied graphics.

   b. Negative shall be manufacturer's baked enamel: black.

   c. Entire sign shall be coated with clear urethane protective coating.

2. Adhesive and Double Stick Tape: Use combination of adhesive and double-stick tape for attaching metal signs to substrates. Double-stick tape holds the sign in position until the adhesive has cured. Provide products as follows:

   a. Double-Stick Tape: Provide Double Coated Polyfoam Mounting Tape. Foam tape shall be .079 inch thick. Tape shall conform to the following:

      1) Density: 6 -pcf
2) Adhesive: 4.5 mils.

3) Adhesion: Peel Shear; 76 ± hrs @ 2 psi.

4) Tensile Strength: 6 lbs./1 "

5) Elongation: 300%

b. Sealant Adhesive: Provide 100% Silicone neutral cure, one component adhesive sealant, conforming to ASTM C920. Provide sealant equal to Dow Corning 832 Plant Maintenance Sealant.

c. Pressure-sensitive adhesive: Pressure sensitive legends use “Scotchcal” brand film as manufactured by 3M or approved equal. Thickness 0.003 inch minimum, 0.006 inch maximum. Material shall consist of tough, flexible, pigmented, vinyl film and shall be processed with compatible screen printing inks and clear coatings as recommended by the film manufacturer. The film shall be pre-coated with pressure sensitive adhesives. The adhesive shall be protected by treated paper liner which shall be easily removable without soaking in water or other solvents.

d. Reflective Sheeting: Pressure sensitive legends use “Scotchlite” brand reflective sheeting manufactured by 3M or approved equal. Thickness 0.0065 minimum, 0.0075 inch maximum. Material shall consist of transparent plastic having a smooth, flat outer surface embedded with spherical lens elements. Material shall be capable to be processed with compatible sheeting manufacturer. The sheeting shall be pre-coated by a treated paper liner that shall be easily removable without soaking in water or other solvents.

3. Frames: Frames shall be heavy duty 12 gage brushed finish aluminum to dimensions and tolerances indicated on Drawings. Frames shall be anchored with fasteners that will be concealed by the finished sign.

2.02 ACCESSORIES

A. Fastening and Anchors

1. Sign fabricator shall design a complete system of fastenings and anchorage devices for the various signs, as required for attachment to the various supporting structures including, but not limited to, concealed clip systems, face screws, and Tight/bollard/parking pole clamp systems.
2. Wherever reasonably possible, fastenings and anchorage devices shall be fully concealed and shall be vandal-proof.

3. Contractor is responsible to provide safe and secure installations in strict conformance to the governing laws and building code.

4. Fully describe proposed fastenings and anchorage devices for each sign type on the shop drawings.

5. Adhesive and Double Stick Tape: Use combination of adhesive and double-stick tape for attaching metal signs to substrates. Double-stick tape holds the sign in position until the adhesive has cured. Provide products as follows:

a. Double-Stick Tape: Provide Double Coated Polyfoam Mounting Tape. Foam tape shall be .079 inch thick. Tape shall conform to the following:
   1) Density: 6 pcf.
   2) Adhesive: 4.5 mils.
   3) Adhesion Peel Shear; -76 ± hrs @ 2 psi.
   4) Tensile Strength: 6 lbs. /1 "
   5) Elongation: 300%

b. Sealant Adhesive: Provide 100% Silicone neutral cure, one component adhesive sealant, conforming to ASTM C920. Provide sealant equal to Dow Corning 832 Plant Maintenance Sealant.

6. Aluminum extrusions: For mounting plates and structural frames shall conform to ASTM B221, Alloy 6063-T-6.

2.03 FABRICATION

A. Sign Copy: Text copy is shown in the Drawings on the signage schedules. Prior to the start of paste-up for each sign, the SEPTA Project Manager reserves the right to make copy changes.

1. Typography: The standard SEPTA type-face is Helvetica Bold as designed and copyrighted by HAAS Type Foundry. Typography shall conform to and shall present a photographic quality image of this type-face.

a. All topography listed as DANGER will be Helvetica Black.
b. All typography shall match the signage schedule for capitalization and punctuation.

2. Sign Layout: Letters and words shall be spaced horizontally according to optical principles based on field width available, letter size, contrast between letter and field colors and other copy of the Sign face. It shall be the Contractor's responsibility to make sure that all copy fits in the field area shown on the sign schedule. If copy will not fit as indicated, the SEPTA Project Manager shall be consulted before any changes in copy, letter size or field arrangements are made.

   a. Right, left, or center copy justification is shown on the sign schedule.

   b. On all directional signs, the circle-arrow is to be vertically centered on the capital letter height of the copy line to which it relates. The circle-arrow outside diameter is in a proportion of 4:3 to the capital letter height. The arrow will be placed on the side of the sign it directs to.

   c. On directional signs with 3" letters, the circle-arrow is spaced horizontally 2" from the flush side margin and 3" from the closest letter of copy. Where other size letters are used, optical spacing adjustments shall be made.

   d. Top and bottom margins of single-line copy on a field are normally one-half of the capital letter height. Where deeper fields (more than 2 times capital letter height) are used, copy is normally spaced one-half or capital letter height from the bottom margin. Exceptions are illustrated in the sign schedule.

   e. On signs with multi-line copy on a single color field, the top and bottom margins, as well as the spacing between lines, is normally one-half capital letter height. Exceptions are illustrated in the sign schedule.

   f. All text will be centered horizontally.

   g. The second and succeeding lines of multi-line copy are aligned flush under the top line of copy on left or right justified fields.

   h. The final graphic image appearance shall be clean and sharp, and the layout of typographic copy shall be straight, even, square, plumb, and level on the graphic film.

3. Symbols: SEPTA shall supply the Contractor with artwork for the SEPTA logo, circle arrow and any other special symbols required for
the work. All symbols will conform to the current addition of the Americans with disabilities guidelines, and SEPTA standard signage manual.

4. All Sign faces shall be labeled on the face of the sign and on the outside of the packaging with the sign numbers. Labels on sign-faces shall be peelable and non-marring.

5. Storage of Film Positives: The Contractor shall store all film positives for a period of five (5) years from the date of Final Payment.
   a. Film positives shall remain the property of SEPTA.

2.04 SOURCE QUALITY CONTROL

A. Obtain all signs from a single manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Substrates: Proceed with Work of this section only when substrate construction and penetration Work have been completed.
   1. Examine substrates, areas and conditions under which Work of this section will be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of the Work.
   2. Do not permit the Work to proceed until unsatisfactory conditions have been corrected.
   3. Commencing Work of this section will be construed as Installer’s acceptance of surfaces, substrates, and conditions with any particular area.

3.02 INSTALLATION, APPLICATION, OR EXECUTION

A. Erection shall be performed by experienced sign erectors. Signs shall be installed true, plumb, and level, located as shown on the Drawings.

B. No field cutting of any sign Work will be allowed.

C. Exercise extreme care in all handling and stacking of signs to avoid chipping.

D. Exact location of signs will be determined by the SEPTA Project Manager in the field.
E. All Work shall be rigidly anchored to the supporting construction, as indicated on the approved shop drawings. Fastenings, except those for the anchorage of supporting members to the structures, shall be concealed.

1. Fabrication and erection of supporting members, and workmanship standards as set forth under Sections 05520 - Handrails and Railings, and 05500 Metal Fabrications.

F. Tactile Signs: Provide sign colors and inscriptions as directed by the SEPTA Project Manager.

1. Inscriptions: Place inscriptions properly in the inscription fields and in strict accordance with the approved details shown. Provide full-size layouts of all inscriptions to the Engineer for approval.

2. No imprints, characters, shields, trade marks, decals, or other markings containing the name of the manufacturer, Contractor, firm or corporation will be permitted on any exposed surfaces.

3. Adhesively anchor signs to substrates as indicated using combination of double-stick tape and silicone surfaces.

4. Tactile signs will be placed 60" above the finished floor in all cases.

G. The General Contractor shall notify the SEPTA Project Manager at least 60 days in advance from the date of removal of existing billboard signage. Demolition of such signage is prohibited without prior SEPTA approval.

3.03 INSTALLATION OF EXECUTION TOLERANCES

A. Overall dimensions of all Sign face artwork shall be within 1/16" of nominal dimensions in each direction.

3.04 FIELD QUALITY CONTROL

A. All items furnished under this Section which are specified to be installed as work of this Section shall be installed in strict accordance with the approved shop drawings and the manufacturer's printed instructions and recommendations, required to be submitted as specified herein above.

B. The installer/erector/fabricator shall examine all substrates, supports, and conditions under which this Work is to be performed and notify Contractor in writing of conditions detrimental to the proper completion of the Work.

C. Do not proceed with the Work until unsatisfactory conditions are corrected.
D. Commencing Work of this section will be construed as acceptance of all substrates and conditions.

E. Acceptance of the Work: Final acceptance of the Work shall be given upon delivery of all the completed Sign faces.

1. Surfaces of the Sign faces shall be clean, unabraded, undefaced, unscratched, and perfectly finished.

2. Signs shall be protected during shipment from damage due to discoloration, scratches; dirt, or any other accidental or malicious cause.

3. Protect signs with strippable coating, protective sleeves, boarding, or other suitable means. Damaged elements shall be replaced by the Contractor at no cost to the SEPTA.

3.05 CLEANING

A. Repair minor damage to eliminate evidence of repair. Remove and replace Work which cannot be satisfactorily repaired.

B. All defective Work, including that exhibiting cracked, chipped, scratched, abraded, or otherwise damaged finishes, shall be removed and replaced with Work conforming to the specified requirements.

C. Surfaces of sign Work shall be cleaned as recommended by the sign manufacture after installation and left in a condition satisfactory to the SEPTA Project Manager.

D. Clean exposed surfaces using materials and methods recommend by manufacturer of material products being cleaned. Remove and replace Work which cannot be successfully cleaned.

E. Provide temporary protection to ensure Work being without damage or deterioration at time of final acceptance. Remove protections and clean as necessary immediately before final acceptance.

END OF SECTION
SECTION 02851

STEEL GUARD RAIL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section covers the furnishing and installation of new guard rail of the type indicated and removal of existing guard rail, including all appurtenances and hardware.

1.02 RELATED SECTIONS

A. Division 1 – General Requirements.

1.03 REFERENCES

A. PENNDOT Publication 408, Section 620.

PART 2 PRODUCTS

2.01 MATERIALS

A. As per PENNDOT Publication 408, Section 620.2.

PART 3 EXECUTION

3.01 PREPARATION

A. As per PENNDOT Publication 408, Section 620.3 and as shown on the contract drawings.

END OF SECTION
SECTION 02890

TRAFFIC SIGNAL SUPPORTS AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for providing traffic signal equipment at the locations indicated on the Contract Drawings.

   a. The Work of this Section includes the labor, incidental materials, and transportation and storage associated with the completion of the installation as shown on the Contract Drawings.

B. Related Requirements:

1. Section 01300 – Submittals
2. Section 01570 – Maintenance and Protection of Vehicles, Pedestrians, and Passengers
3. Section 01700 – Contract Closeout
4. Section 02222 – Excavation, Backfill and Compaction for Utilities
5. Section 02300 – Tunneling, Boring and Jacking
6. Section 03300 – Cast-In-Place Concrete
7. Section 16129 – Fiber Optic Cable
8. Section 16131 – Conduit
9. Section 16210 – Electrical Utility Services

1.02 REFERENCES

A. Abbreviations and Acronyms:

1. AWG: American Wire Gage.
2. LED: Light Emitting Diode

B. Definitions:
C. Reference Standards:

1. Pennsylvania Department of Transportation (PENNDOT)
   b. *Publication 408* – Construction Specifications
   c. *Publication 111* – Pavement Markings and Signing Standards
   d. *Publication 213* – Work Zone Traffic Control Guidelines

2. United States Government:
   a. U.S. Department of Transportation (USDOT)
      1) Federal Highway Administration (FHWA)
         a) Manual on Uniform Traffic Control Devices (MUTCD)

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate street closings and traffic control with PENNDOT and with other appropriate government agencies.
   a. Obtain all permits required by PENNDOT, and pay necessary fees.
   b. Reference *Publication 213* for appropriate traffic control during construction activities

2. Coordinate with electric utility to energize all applicable Traffic Signal Equipment.

3. Obtain the approval of serving utilities to disconnect, relocate, and/or provide temporary or new utility service connections and lines as needed for aerial and underground construction.

B. Sequencing:

1. Include provisions for traffic control during installation of the traffic signal supports and equipment in *Publication 213* including provisions for the placement and maintenance of barriers required to protect the workers and the public during construction operations.
1.04 SUBMITTALS

A. Action Submittals:

1. Submit the following to the Program/Project Manager for approval in accordance with the requirements of Section 01300, Submittals:

a. Product Data:

   1) Conduit, couplings, and pull boxes.
   2) Signal faces and wiring.
   3) Video detection equipment.
   4) Radar detection equipment.
   5) Emergency preemption equipment.
   6) Power service cabinet.
   7) Fiber optic cable and connectors.
   8) Traffic signal controller and cabinet and cabinet contents.

b. Shop Drawings:

   1) Layout drawings.

c. Qualification Statements:

   1) IMSA technician/electrician’s qualifications.
   2) Electricians’ qualifications.

B. Closeout Submittals:

1. Submit the following to the Program/Project Manager in accordance with the requirements of Section 01700, Contract Closeout:

a. Record Documentation:

   1) As-built information for traffic signal equipment.

1.05 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. An International Municipal Signal Association (IMSA) Technician/Electrician must be onsite at all times during construction of the traffic signal supports and equipment.

B. Qualifications:

1. International Municipal Signal Association (IMSA) Technician/Electrician’s Qualifications:
   a. Employ a Level II IMSA-certified Technician/Electrician.
   b. Submit the International Municipal Signal Association (IMSA) technician/electrician’s qualifications to the Program/Project Manager for approval.

2. Electricians’ Qualifications:
   a. Employ a qualified Journeyman Electrician who has successfully completed a recognized 4-year electrical apprenticeship program or equivalent training, or a person enrolled in a recognized 4-year electrical apprenticeship program under the direct supervision of a Journeyman Electrician.
   b. Submit the electricians’ qualifications to the Program/Project Manager for approval.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. Product Data:

1. Submit Product Data for the products and materials proposed for the Work of this Section to the Program/Project Manager for approval.

2. All products and materials must be approved by the Program/Project Manager and PennDOT District 6-0 prior to ordering. All products and materials for the traffic signal shall be confirmed to meet current PennDOT District 6-0 standards, and be from pre-approved vendors.

B. Shop Drawings:

1. Submit layout drawings for traffic signal poles and mast arms, including structural calculations, to the Program/Project Manager for approval.
2.02 MATERIALS

A. Provide equipment as specified in the Contract Documents and in accordance with Publication 148, Publication 111, and Publication 408 and as directed by the Project Engineer.

B. Foundations for Poles, Power Service Pedestals, and Cabinets:

1. Provide foundations and associated hardware conforming to Publication 148 and Publication 408 and as directed by the Project Engineer.

C. Fiber Optic Communication Cable

1. Provide fiber optic cable and associated hardware to provide communication between local controllers. Include all equipment needed to determine splice losses, attenuation losses, cable integrity, and fiber distance data. Fiber optic cable shall meet all requirements outlined in Section 957 of PennDOT’s special provisions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:

1. Prior to beginning construction operations, perform a field investigation with the Program/Project Manager.

2. Prior to beginning excavation operations, mark in the field the foundation locations for poles, controller cabinets, junction boxes and other foundations shown on the traffic signal plans in the Contract Drawings.

B. Evaluation and Assessment:

1. At the time of the inspection, the Program/Project Manager may adjust pole locations from the planned or marked locations to accommodate circumstances found at the Site.

2. Before the excavation of any foundation may proceed, the Program/Project Manager must approve the foundation locations in writing.

3.02 PREPARATION

A. Protection of In-Place Conditions:
1. Ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities by construction operations.
   a. Do not close or obstruct streets without permission from the Authorities Having Jurisdiction.
   b. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
      1) Ensure safe passage of persons around the area of construction.

3.03 CONSTRUCTION

A. Complete all construction in accordance with Publication 111, Publication 148, Publication 213, and Publication 408 and as instructed by the Project Engineer.

B. Install fiber optic communication cable per the manufacturer’s specifications. Make all connections of the fiber optic cable in intersection controller assemblies using fiber optic fusion splices. No additional splices between controllers are allowable.

3.04 SITE QUALITY CONTROL

A. Perform Tests and Inspections in accordance with Publication 408.

B. Perform the following tests on the fiber optic communication cable.

1. Test the cable with a calibrated power meter/light source unit pair that is portable, battery operated and allows quick field changes of adapters for "SMA" and "ST" type connectors. Unit utilized to meet or exceed the following parameters for operation on 62.51125 micron meter multimode fiber:
   a. Operating Wave Length: 850 nm
   b. Range: +3 to -45 dBm
   c. Measurement Scale: dBm
   d. Accuracy: 0.5 dB or better

2. Test the cable with a field unit Optical Time Domain Reflectometer for operation on multimode fiber (62.51125 micron meter) at 850 nm wavelength, meeting the following criteria:
   a. Dead zone: 15 meters or better
b. Attenuation Range: 15 dB or better

c. Distance Range: 10 Km or longer

d. Accuracy: plus/minus 2.0 meters

e. Printer: Must be capable of printer output or software storage

3.05 SYSTEM STARTUP

A. Final acceptance of the traffic signal system will be determined by the Program/Project Manager and PennDOT District 6-0 after all discrepancies and/or modifications are completed.

END OF SECTION
SECTION 02900

PLANTING

PART 1  GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for landscape plantings including, but not limited to, the following:
   a. Furnishing and placing topsoil.
   b. Furnishing and planting landscape plantings.
   c. Selective pruning.
   d. Mulching.
   e. Fertilizing.
   f. Watering.
   g. Providing maintenance for deciduous trees, shrubs, perennials, and grasses.
   h. Clean up of extraneous landscaping materials.

B. Related Sections:

1. Section 01300 – Submittals.
2. Section 02910 – Topsoil.
3. Section 02936 - Seeding and Soil Supplements.

1.02 REFERENCES

A. American Nursery and Landscape Association (ANLA™)/American National Standards Institute (ANSI):
   1. ANSI Z60.1, American Standard for Nursery Stock.

B. American Joint Committee on Horticultural Nomenclature (AJCHN):
   1. AJCHN Standardized Plant Names.
C. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO T 89, Standard Method of Test for Determining the Liquid Limit of Soils.

D. Association of Analytical Communities International (AOAC):
   1. AOAC Official Methods of Analysis of AOAC International.

E. Pennsylvania Department of Transportation (PENNDOT) Specifications:
   1. PENNDOT *Publication 408*, Specifications.

1.03 SUBMITTALS

A. Submit the following information to the SEPTA Project Manager for approval in accordance with the requirements of Section 01300:

1. Product Data:
   a. Proof of non-availability as justification for substitutions per Subparagraph 2.03B.1.

2. Shop Drawings:
   a. Proposed planting schedule per Subparagraph 1.07A.1.

3. Quality Assurance/Control Submittals:
   a. Test Reports.
   b. Certificates.
      1) Certificates of inspection per Subparagraph 1.04B.2.a.
      2) Other necessary data substantiating that the materials comply with the requirements specified per Subparagraph 1.04B.2.b.

4. Manufacturers’ Instructions:
   a. Maintenance instructions per Subparagraph 1.09D.1.

5. Closeout Submittals:
   a. Warranty per Paragraph 1.08C.
1.04 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Provide materials and perform the work of this Section to comply with the requirements of those industry standards cited and the applicable provisions of Section 808 of PENNDOT Publication 408, except as may be amended herein.

B. Certifications:
   1. Analysis and Standards:
      a. For standard products, provide the manufacturer's certified analysis of the contents with the package.
      b. For other materials, provide analysis of the contents by a recognized laboratory performed in accordance with methods established in the AOAC Official Methods of Analysis of AOAC International, wherever applicable.
   2. Plant and Planting Material Certifications:
      a. Submit certificates of inspection as required by governmental authorities.
      b. Submit other necessary data substantiating that the materials comply with the requirements specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Comply with the regulations applicable to landscape materials.
   1. Include certificates of inspection required by governing authorities with shipments of landscape materials.

B. Temporary Storage:
   1. When temporary storage or heeling-in of plants is required prior to shipping the plant stock, provide and prepare a suitable heeling-in ground or well-ventilated and cool storage shed located near the planting site.

C. Protect materials from deterioration during shipment, delivery, and while stored at the Site
   1. Handle and pack each species or variety of plant in an approved manner as required by soil and climatic conditions at the time of
digging, and with due regard to shipping conditions and the time to be consumed in transit and delivery.

2. If accepted planting stock is not planted immediately, properly heel-in or store it.
   a. Stock left out of the ground and unprotected overnight, left with roots exposed to heat or freezing, or otherwise unprotected during transit, unloading, heeling-in, or planting will be rejected.

3. Do not remove container-grown stock from containers until planting time.

D. Deliver packaged materials in unopened containers showing the weight, analysis, and name of its manufacturer.
   1. Deliver commercial fertilizer to the Site in the original, unopened containers, each bearing the manufacturer's guaranteed analysis.
      a. Any commercial fertilizer that becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.

E. Deliver plant materials to the site in a protected condition to prevent wind damage and drying.
   1. Provide plants that have been freshly dug at the time of delivery.
   2. Plant material exhibiting a heated or sweated condition due to tight packing or poor ventilation is subject to rejection.

F. Provide data on the landscape material labels substantiating that the plants, trees, shrubs, and planting materials comply with specified requirements.
   1. Deliver plants with a securely attached waterproof tag legibly indicating the plant’s name and size in accordance with ANSI Z60.1.
      a. In all cases, give precedence to botanical names over common names.
   2. Provide at least one tagged plant in each bundle or lot.

G. Deliver trees and shrubs after preparations for planting have been completed, and plant them immediately.
   1. Do not prune trees and shrubs prior to delivery unless otherwise approved by SEPTA Project Manager.
   2. Prior to digging evergreen trees, apply anti-transpirant to the trees.
3. Provide protective covering for trees and shrubs during shipment.

4. Do not drop balled and burlapped stock during delivery or handling.

5. Do not bend or bind-tie trees or shrubs in such manner as to damage their bark, break their branches, or destroy their natural shape.

6. If planting is delayed more than 6 hours after their delivery, set trees and shrubs in the shade, protect them from weather and mechanical damage, and keep their roots moist by covering them with mulch, burlap, or other acceptable means of retaining moisture.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. The following seasonal constraints govern when the Work of this Section can be performed, except that when environmental conditions warrant, the SEPTA project Manager may extend the specified dates.

a. Allowable Plant Setting Dates:

   1) Deciduous Trees and Shrubs: October 15 to May 15.

   2) Evergreen Trees:

      a) Spring: March 1 to May 15.

      b) Fall: August 1 to September 15.

   3) Seedlings and Seedling Transplants: March 1 to May 15.

2. Do not perform the Work of this Section when soil or weather conditions are unsuitable.

   a. Unsuitable conditions include moisture saturated or frozen in place soil and precipitation of any kind present or occurring during the Work.

3. The Work of this Section may include dormant or cold weather planting procedures for appropriate species, including staking plant materials and installing protective mulch on plant pit locations to protect the soil against freezing prior to winter plantings.

   a. Plant dormant deciduous trees suitable for such seasonal operations, in order that landscaping can be in place at the earliest possible time.
B.  Existing Conditions:

1.  Plant trees and shrubs after the final grades are established and prior to the planting of lawns unless otherwise acceptable to SEPTA Project Manager.
   
a.  Maintain the grade stakes until it is mutually agreed to by the parties concerned to remove them.
   
b.  If the planting of trees and shrubs is to occur after lawn work, protect the lawn areas and promptly repair damage to lawns resulting from planting operations.

2.  Perform the Work of this Section in a manner that avoids damaging in-place utilities.
   
a.  Hand excavate as required.

1.07  SCHEDULING

A.  Planting Schedule:

1.  Submit a proposed planting schedule to the SEPTA Project Manager that indicates the dates for performing each type of landscape work in various areas of the Site during normal seasons for such work.
   
a.  Once accepted, only revise schedule dates as approved in writing by the SEPTA Project Manager, and after submitting documentation of the reasons for the changes.

2.  Proceed with, and complete landscape work as rapidly as portions of the Site become available, working within seasonal limitations for each kind of landscape work required.
   
a.  Plant or install materials during the normal planting seasons for each type of plant material required.

3.  Correlate the planting schedule with specified maintenance periods to provide maintenance from the date of Substantial Completion.

1.08  WARRANTY

A.  Warrant trees and shrubs for a period of one year after the date of acceptance or until the specified maintenance period specified in Paragraph 1.09A ends, whichever is later, against defects.

1.  Defects include death and unsatisfactory growth, except for defects resulting from neglect by SEPTA, abuse or damage by others, or
unusual phenomena or incidents which are beyond the Contractor’s control.

2. The date of acceptance is defined as the date for the inspection requested by the Contractor after the last planting is installed and mulched, and at which time all conditions are acceptable to the SEPTA Project Manager.

3. Although periodic requests for payment will be accepted, their individual approval and subsequent payment does not activate the warranty period until all plants are in place and inspected by the SEPTA Project Manager.

B. Provide a warranty that does not limit plant replacement to “one time”; replace plants as many times as necessary in a single location until acceptance.

C. Submit the warranty in writing as part of the closeout submittals for the Contract.

1.09 MAINTENANCE

A. Maintenance Period:

1. Begin maintenance operations immediately after seeding is performed and continue them throughout construction and the warranty period.

B. Maintenance Requirements:

1. Maintenance includes, but is not limited to, weeding, applying mulch as needed, controlling insects and diseases, and performing other particular operations as specified.

   a. Maintain all mulched landscaped areas as specified throughout the warranty period, including rescuing and replacing mulch that has sloughed off and weeding mulched areas.

   b. Maintain and adjust stake wires if necessary.

   c. Perform pruning, other than initial pruning, as necessary to remove dead leaders and branches.

C. Watering:

1. Thoroughly water plants at least bi-weekly and in a satisfactory manner during the construction period until acceptance.
a. Water plant root systems at regular intervals and keep the surrounding soil in condition to promote root growth.

2. Provide all necessary water, tank trucks, hoses, and appurtenances.

D. Maintenance Instructions:

1. Prior to the expiration of the required maintenance period, submit typewritten recommended procedures to be established by SEPTA to maintain landscape work for one full year.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plant Materials:

1. Provide plants true to type and name in accordance with the latest edition of AJCHN Standardized Plant Names nomenclature.

   a. Properly label each plant with its type and name.

      1) Where a formal arrangement or consecutive order of trees or shrubs are shown on the Contract Drawings, select stock for uniform height and spread, and label it with numbers to assure symmetry in planting.

   b. Provide the quantity of trees, shrubs, and plants of the size, genus, species, and variety shown and scheduled for landscape work and that comply with the recommendations and requirements of ANSI Z60.1 and recognized horticultural sources.

   c. Unless otherwise specified, provide Grade No. 1 plants in accordance with ANSI Z60.1.

2. Provide nursery-grown stock unless otherwise indicated or specified.

   a. Provide healthy, vigorous stock, grown in a recognized nursery in accordance with good horticultural practice and free of disease, injurious insects, eggs, larvae, and defects such as mechanical wounds, broken branches, decay, knots, sun-scald, injuries, abrasions, disfigurement, or any other defect.

   b. Provide plants having well-branched, vigorous, and balanced root and top growth.
c. Provide deciduous trees having straight trunks with well-branched tops and a single leader.

d. Provide plants that have been growing in a climate comparable to that of the Site for at least two years.

3. “B and B” Plants:

a. If plants are designated herein or on the Contract Drawings as “B and B,” provide balled and burlapped plants as follows:

1) Form a ball from the original and undisturbed soil in which the plant grew.

2) Wrap the ball with burlap or similar approved material, and tightly lace it to hold the ball firm and intact.

3) Provide “B and B” plants having a ball diameter and depth in accordance with ANSI Z60.1 and sufficiently large to include the necessary root system.

4. When containers are indicated or specified, furnish and plant plants in approved decomposable containers if possible.

a. Remove non-decomposable containers as the plant is placed in ground.

5. Minimum Acceptable Plant Sizes:

a. Provide plants of sizes conforming to the measurements indicated on the Contract Drawings or specified.

1) Measure plants before pruning with the branches in normal position.

2) Plants larger in size than indicated may be used if acceptable to the SEPTA Project Manager and if the sizes of root balls are increased proportionately, but at no additional cost to the SEPTA.

a) If larger plants are used, proportionately increase the root ball or spread of roots in accordance with ANSI Z60.1 rules.

6. Provide freshly dug trees and shrubs.

2.02 ACCESSORIES

A. Anti-transpirant:
1. Provide an organic, non-toxic, biodegradable anti-transpirant spray that forms a clear, protective coating on foliage to help plants retain moisture.

2. Provide products as manufactured by the following firms:
   a. Wilt Pruf Products, Inc., P. O. Box 469, Essex CT 06426-0469, Telephone (800) 972-0726.
   b. Or approved equal.

B. Backfill:

1. Provide backfill for trees, shrubs, and root pruning trenches that consists of 80 percent topsoil and 20 percent peat moss, or in other words 4 parts topsoil to 1 part peat moss.

C. Backfill mix:

1. Provide backfill mix consisting of 4 parts topsoil, 1 part sphagnum peat, and 1 pound of bone meal for each cubic yard of topsoil.
2. Mix the backfill mix in bulk in a preparation area, and do not individually place and mix it within the plant pits.

D. Guy Stakes:

1. Provide wooden guy stakes, free of knots or other structural defects that would cause breakage while the stake is being pounded into place.
   a. Dimensions: 2 inches by 2 inches by 8 feet in length, minimum.

E. Guy Wire:

1. Provide twelve-gauge minimum, multi-stranded, galvanized steel wire for guying plants covered with rubber hose where it would otherwise come into contact with the plant as shown in the Contract Drawings.

F. Gypsum:

1. Provide gypsum as commercially available for planting uses.

G. Herbicides:

1. Pre-emergent herbicide:
a. Provide pre-emergent surface-applied herbicide capable of providing control of key grasses and broadleaf weeds.

b. The standard of quality is Surflan pre-emergent herbicide as manufactured by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189, telephone (800) 258-3033.

2. Post-emergent herbicide:

a. Provide post-emergent herbicide designed for aquatic use with no restrictions on water use, specifically domestic use, after application.

b. The standard of quality is Rodeo as manufactured by Monsanto Company, 800 North Lindbergh Boulevard, St. Louis, MO 63167, telephone (314) 694-1000.

H. Mulch:

1. Plant Mulch:

a. Provide brown, coarse textured tanbark, a by-product of the tanning process, or hardwood and pine bark consisting of ground or shredded bark, a fibrous material free from foreign material and substances toxic to plant growth and having the following properties.

   1) Acid reaction: Four to five of that of shredded oak tree bark.

   2) Moisture Content: 15 to 40 percent natural.

   3) Particle Size: In the range from 1/2-inch to 2-inch diameter.

   4) Grade: Processors Number 1.

2. Mulch Binder:

   a. Provide nonasphaltic emulsion mulch binder consisting of either a water soluble product consisting of a blend of vegetable gum and gelling/hardening agents, or a water soluble product consisting of hydrophilic polymers, viscosifiers, and sticking aids and gums.

   b. Asphalt emulsion binders are not acceptable.

I. Soil Supplements:
1. Provide soil supplements in accordance with the requirements of Section 02936.

J. Topsoil:

1. Provide topsoil in accordance with the requirements of Section 02910.

2.03 SOURCE QUALITY CONTROL

A. The SEPTA project Manager may inspect trees and shrubs either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and quality.

1. The SEPTA Project Manager has the right to further inspect trees and shrubs for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work.

B. Inform the SEPTA Project Manager of the source of supply for plant material for this Contract so that he has the opportunity to select the materials at the source.

1. Not less than 14 days prior to installing plantings, submit complete and detailed information concerning the source of supply for each item of plant material on the planting list that appears on the Contract Drawings.

2. Make all planting stock available for inspection in the nursery before it is dug.

C. Do Not Make Substitutions:

1. If specified landscape material is not obtainable, submit proof of non-availability to the SEPTA project Manager, together with a proposal for the use of equivalent material.

PART 3 EXECUTION

3.01 PREPARATION

A. Utilities:

1. Determine the locations of underground utilities and mark the locations with stakes or flags.

B. Excavation:
1. When conditions detrimental to plant growth, such as rubble fill, adverse drainage conditions, or obstructions, are encountered during excavation notify the SEPTA project Manager and obtain direction before planting.

C. Shrub Bed Preparation:

1. For the shrub masses shown on the Contract Drawings, provide a continuous bed for each mass planting.
   a. Strip the bed of turf, and cultivate the entire area by incorporating peat and any required soil supplements into the top 6 inches of the existing topsoil.
      1) Cultivate the area by rototilling or plowing and discing so that the entire surface is tilled.
   b. Incorporate a quantity of peat into the topsoil equal to 3 inches of peat spread uniformly over the plant bed.
   c. For shrub, ground cover, and other planting beds in areas where extensive weed elimination is necessary, take the following additional measures to prepare the beds prior to disturbing the planting bed areas:
      1) Apply a pre-emergent herbicide to the areas per the herbicide manufacturer's instructions.
         a) Take care to assure the pre-emergent herbicide is placed only in the area of the plant bed.
      2) Apply a frill or injection method application of a post-emergent herbicide to woody vegetation of a size larger than 1-inch caliper per the herbicide manufacturer's instructions.
         a) Apply this to all woody stumps remaining from previous clearing operation.
         b) Paint the frill application on a fresh cut stump area.
      3) Apply a spray application of a post-emergent herbicide to the proposed plant bed area per manufacturer's instructions.
         a) Take care so that overspray does not extend beyond the bed areas.
b) Verify that plants to be eliminated are in an active growing state prior to applying the spray.

4) After a 7-Day waiting period, determine if a repeat application of the post-emergent herbicide is required.
   a) If weeds and the existence of vegetation in the area of the plant bed are evident, apply a second application.

5) After a 7-Day waiting period beyond the final post-emergent herbicide application, dig out woody plant stumps larger than 1 inch caliper, including the roots, and dispose of them off-site.

6) Remove any existing vegetation not killed by the herbicide application by hand digging, and removed it off-site.

7) Cultivate the beds as specified in Subparagraphs 3.01C.1.a and 3.01C.1.b.

D. Plant Pit Preparation:

1. Prepare planting beds, plant trenches, and plant pits to the depths required below finished grade according to the recommended practices of ANSI Z60.1.

2. Excavate plant pits with vertical sides and flat bottoms.
   a. Construct plant pit diameters at least twice the diameter of the plant root ball with at least 6 inches of open excavation between the root ball and the vertical wall of the pit in all directions.
   b. Refer to the planting details on the Contract Drawings for further information.

3. For pits for larger plants, such as deciduous shade trees and evergreens, provide sufficient depth to allow placing the root ball on the subgrade prior to backfilling.
   a. Construct plant pit diameters at least twice the diameter of the plant root ball with at least 12 inches of open excavation between the root ball and the vertical wall of the pit in all directions.
   b. Refer to the planting details on the Contract Drawings for further information.
4. Plan digging operations, particularly those on slopes, in order that actual planting operations will follow within 24 hours.
   a. In the case of winter season planting, do not excavate the plant pit and allow it to freeze.
      1) Perform digging operations so that plants can be properly installed and backfilled before the pit or the excavated material freezes.
      2) Replace the mulch immediately to further protect the pit and root ball from freezing.

3.02 INSTALLATION

A. Plant Setting Operations:
   1. Perform planting operations in conformance with planting details shown on the applicable Contract Drawings.
   2. Set plants plumb and straight with allowance for settlement and in accordance with following:
      a. Set plants to insure that after settlement the plant stem projects from the soil as much as before transplanting.
      b. Set plants no shallower or deeper than they stood in the nursery, and excavate pits as specified in Paragraph 3.01D to the correct depth to set the plants at their proper height.
   3. Setting Ground Cover Plants:
      a. Set each plant in a slight depression for catching rainwater, and top-off such depressions with 3 inches of mulch spread uniformly and compacted.
      b. Thoroughly water the ground cover bed immediately following planting.
   4. Setting Balled and Potted Plants:
      a. Set each plant in prepared circular pits deep enough to accommodate a bed of topsoil not less than six inches deep under the ball or pot of shrubs and 12 inches under the ball of trees.
      b. Handle balled and burlapped plants by the earth ball, and not by the plant itself.
1) After placing balled and burlapped plants in their pits without removing the burlap, lay the burlap back from the ball.

2) Remove burlap from the top third of root balls, and completely remove ropes, twine, and wires from root balls.

c. Completely remove containers from potted plants; however, keep the earth unbroken around roots.

d. Place backfill mix in plant pits under and around root balls in 6-inch layers and tamp to eliminate voids.

1) At the halfway point in backfilling, flood the pit with water and continue backfilling after the water dissipates.

a) Place a 3-inch layer of plant mulch within the ring prior to watering.

2) Backfill pits to grade, and build up a ring of soil 3 inches deep over the edge of the plant pit to facilitate maintenance watering.

5. Immediately after plant setting and prior to watering, evenly apply mulch over planting areas not more than 3 inches deep.

B. Backfilling:

1. Planting areas are considered to have sufficient topsoil for preparing beds; however, furnish and place the topsoil required within each plant pit for backfill mix.

   a. Place the backfill in 6-inch increments of depth.

   b. Work the backfill mix around plant balls in the pits and firmly tamp and/or puddle it as backfilling progresses

   c. Take care to fill all voids in order to eliminate air pockets.

   d. If necessary, and always in the case of shade trees, hold each plant in a vertical position while the backfill soil is being placed.

   e. Remove sticks, sod, clods, or other material that could decompose and form air pockets in the planting media.

2. On level ground and on relatively gentle slopes, leave a shallow basin, the diameter of the plant pit, around each plant.
3. On steep slopes, pull sufficient soil to the lower side of the plant to form a shallow basin to catch and hold water.

C. Fertilization:

1. After placing backfill, prior to final watering, and before mulching, apply fertilizer to all plants at the following rates:
   a. Evergreen Trees: 1/8 pound per foot of height.
   b. Shade Tree: 2 pounds per inch of caliper.
   c. Deciduous Shrub: 1/4 pound per foot of height.
   d. Evergreen Shrub: 1/8 pound per foot of height.
   e. Flowering Tree: 1 pound per inch of caliper.

D. Applying Plant Mulch:

1. Remove weeds and deleterious materials from the area before spreading plant mulch.

2. Mulch plant beds and pits as follows:
   a. Mulch plants after they are planted with tanbark to a uniform depth of 3 inches.
      1) Except in the case of winter planting, place mulch within 2 days after planting
         a) In the case of winter planting, place mulch immediately.
      2) Mulch tree pits to the outer edge of the earth berm.
      3) Mulch the shrub plantings, which are masses, with mulch covering the entire area within the limits of the plant mass.
      4) Adjust grades, allowing for the thickness of the mulch by cutting or filling.
   b. Rake the surface smooth and even over the prepared surface.
   c. After leveling the mulch, thoroughly soak it with water to the full depth of the mulch.

E. Pruning:
1. Prune new plant material as necessary to remove injured twigs and branches and to compensate for loss of roots during transplanting, but never prune more than half of the original branch structure.
   
a. Only prune damaged or broken main roots of new materials with a clean oblique cut immediately above the point of damage.

b. Conform pruning operations to the best horticultural practices with due respect to natural form and growth characteristics of the individual species.

2. Prune the tops of all deciduous stock at the time of planting or immediately thereafter.
   
a. Preserve a single terminal leader when pruning deciduous trees.

b. Paint cuts over 3/4-inch in diameter with an approved tree-wound paint.

3. Prune existing trees indicated to remain to remove all dead and interfacing branches.
   
a. Remove lower branches to provide a minimum clearance of 5 feet from finished grade

b. Paint cuts over 3/4-inch in diameter with an approved tree-wound paint.

3.03 REPAIR/ RESTORATION

A. If a plant dies or deforms after acceptance but during the warranty period, remove and replace it immediately; or, in the case of plants requiring proper seasonal planting, replace it in the next appropriate season, even if that season falls beyond the warranty period.

1. If a large portion of a plant dies back causing a permanent or long-term deformity, replace it.

2. Replace plants as many times as necessary in a single location during the warranty period.

3. Replace all plants that are dead, unhealthy, or in a badly damaged condition with plants of the same exact type, species, and size originally specified.
4. Do not make replacements during seasons definitely unfavorable for planting.

5. Remove rejected trees or shrubs immediately from the Site, at no cost to SEPTA.

6. Any delay on the part of the Contractor in removing and replacing unsatisfactory materials is cause for SEPTA to have such work performed and to back charge the Contractor for that work.

B. If damage to the structures, grounds, equipment, and/or their contents develops within the stipulated warranty period and is due to the use of material or workmanship which are inferior, defective, or not in accordance with this Contract, make good all unsatisfactory conditions or damage, and make good any work or materials or grounds which are disturbed in fulfilling the requirements of the warranty.

1. Make such additional repairs and replacements as required by the SEPTA Project Manager at no additional cost to the SEPTA.

3.04 FIELD QUALITY CONTROL

A. Provide planting stock that conforms to the requirements of the ANSI Z60.1, and to the Laws of the State of Pennsylvania.

1. Any plants furnished with fine hair roots omitted, or with main roots cut, will be immediately rejected.

2. “B and B” plants arriving with broken or loose balls, or having “manufactured” earth in lieu of the original and undisturbed soil in which the plant grew will be rejected.

B. Provide planting stock declared and certified to be free from disease and insect pests of all kinds.

1. Accompany each shipments, invoices, or orders of plants with all necessary inspection certificates, and give them to the SEPTA Project Manager upon arrival at the point of delivery.

C. Final inspection and acceptance of all planting stock will be made at the planting Site prior to the plants being placed in their permanent position.

1. At the conclusion of the maintenance period, the SEPTA Project Manager will make an inspection of the landscaping work to determine its condition for acceptance.
3.05 CLEANING

A. As the landscape work is completed during the Contract and at intervals as directed by the SEPTA Project Manager, clear the site of all extraneous materials, including quantities of subsoil, rock, other spoils remaining from excavation after planting, and rubbish or debris; and leave all planting sites in a clean, safe, neat, sightly condition.

3.06 PROTECTION

A. After plant setting work, install stake and guy supports on those plants indicated as being staked to prevent uprooting by wind or otherwise.

1. Staking Trees:
   a. Within three days after planting, stake trees as follows:
      1) Stake trees up to 2 inches caliper with 2 stakes.
      2) Stake trees over 2 inches caliper with 3 stakes.
      3) Stake evergreen plants 6 feet tall and taller with 2 stakes.
   b. Stake trees at the perimeter line of the root ball as detailed on the Contract Drawings.
   c. Drive stakes vertically, and not twisted or pulled, and to a sufficient depth to hold the tree rigid.
   d. Replace or pound flush with the top of the soil stakes with a broken or jagged top.

2. Guy Wire:
   a. Do not allow guy wire to come in contact with the plants.
   b. Cover guy wire with rubber hose as shown in the Contract Drawings where such contact points would otherwise occur.

3. Do not locate stakes and guy supports where pedestrian safety would be endangered.

4. At the end of the one-year warranty period, remove all guying materials.

B. Protect seeded areas from washouts by one of the methods specified in this Section.
1. Should washouts and bare spots develop resulting from inadequate protection or otherwise, perform such reseeding as required until a healthy, complete coverage stand of grass is obtained.

C. Use temporary barricades to protect lawn areas from foot traffic or other uses until a healthy, total coverage stand of grass is obtained.

1. Barricade materials subject to SEPTA Project Manager’s approval.

END OF SECTION
PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for the preparation and fine grading of topsoil subgrade.

2. Requirements for furnishing, spreading, and testing topsoil and humus.

B. Related Sections:

1. Section 01300 - Submittals.

2. Section 02936 - Seeding and Soil Supplements.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T 89, Standard Method of Test for Determining the Liquid Limit of Soils.

B. ASTM International (ASTM):


C. Association of Analytical Communities International (AOAC):

1. AOAC Official Methods of Analysis of AOAC International.

1.03 PERFORMANCE REQUIREMENTS

A. Provide topsoil for all areas within the limits of the Contract that meet both of the following criteria:

1. Areas disturbed by changes in grade, site clearing, or Contractor operations.

2. Areas not to be paved, not containing plantings or structures, and that will not be disturbed by utility construction.
B. Prepare the topsoiled areas for seeding and lawn establishment.

1.04 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Section 01300:

1. Quality Assurance/Control Submittals:
   a. Test Reports:
      1) Topsoil analysis and recommendations for soil supplements per Subparagraph 3.03A.1.b and Subparagraph 3.03A.3.a.
      2) Humus analysis per Subparagraph 3.03A.2.b.

1.05 PROJECT CONDITIONS

A. Do not perform finish grading during unsuitable weather.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil:

1. On-site, previously stripped topsoil that has been stockpiled for reuse may be used for planting and seeding operations.
   a. Use topsoil of uniform quality, free from hard clods, roots, sods, stiff clay, hard pan, stones larger than 1 inch, lime cement, ashes, slag, concrete, tar residue, tarred paper, boards, chips, sticks, or any undesirable material.

2. If additional imported topsoil is required for planting and seeding backfill, provide topsoil that meets the following requirements from an approved off-site source:
   a. Provide new topsoil consisting entirely of earth and organic materials that are fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds, and other litter, and free of roots, stumps, stones larger than 1 inch in any dimension, and other extraneous or toxic matter harmful to plant growth.
      1) Obtain topsoil from local sources, or from areas having suitable soil characteristics, where the soil has the proven ability to grow crops.
a) Before delivering the topsoil to the Site, submit a written statement certifying the locations of the properties from where the topsoil is to be obtained, the names and addresses of the owners, the depth to be stripped, the crops grown, and the fertilizers and pesticides applied during the past 2 years.

2) Obtain topsoil only from naturally, well-drained sites where topsoil occurs to a depth of not less than 4 inches.

a) Do not obtain topsoil from bogs or marshes.

3. Limit the maximum particle size to that capable of being readily placed and compacted in loose 6-inch layers.

4. If necessary, take steps to make it conform to the acceptable pH acidity range and percentage of organic matter specified:

B. Water:

1. Provide water suitable for irrigation and free from ingredients harmful to plant life.

C. Humus:

1. Provide dark brown to black domestic natural humus consisting of reed or sedge peat, granulated and free of lumps, that can be readily incorporated into topsoil, and meets the following requirements:

   a. Size: Provide humus capable of passing through a 1/2-inch screen.

   b. Composition:

      1) Provide humus free from sticks, stones, weedy roots, or other foreign matter; and having ample water-holding capacity and ability to retain plant food.

      2) Provide humus low in wood material, iron, and sulfur ash content.

   c. Percent Moisture: Between 35 and 50 percent when delivered from stockpiles.

2. Acceptable Products:

b. Or approved equal.

2.02 EQUIPMENT

A. Compaction Roller:
   1. Furnish a compaction roller weighing approximately 500 pounds.

B. Watering Equipment:
   1. Furnish hose and other watering equipment required for the work.

PART 3 EXECUTION

3.01 PREPARATION

A. Subgrade:
   1. After construction work is finished and rough grading has settled and been approved but prior to finish grading, remove all sticks, stones, and foreign material one inch or greater in size from the subgrade to receive topsoil.

   2. Harrow or otherwise loosen the subgrade to a depth of 3 to 4 inches.

3.02 APPLICATION

A. Spreading Topsoil:
   1. Spread topsoil over areas to be seeded, planted, or scheduled to receive additional topsoil; and conform it smoothly to the lines, grades, and elevations shown on the Contract Drawings.

      a. Spread topsoil to a depth of 6 inches, after natural settlement.

B. Grading Topsoil:

   1. After spreading the topsoil, rake up large stiff clods, hard lumps, roots, litter, and other foreign matter and stones larger than 3/4 inch in their greatest dimension.

      a. Remove this raked material from the premises, or dispose of it where directed in a satisfactory manner.
2. Fine grade and rake the topsoiled areas to a smooth, uniform surface.
   
a. Apply humus to the surface of the spread topsoil, and work it into the mix during raking operations.
   
b. Apply a quantity of humus as necessary to meet the 5 percent organic matter content specified.

C. Compacting Topsoil:

   1. Compact the topsoil with an approved roller.

   2. Re-grade and re-roll the topsoil until satisfactory grades as shown on the Contract Drawings are obtained having the required depths of topsoil

D. Soil Supplements:

   1. Apply lime and fertilizer mixed as specified in Section 02936.

3.03 FIELD QUALITY CONTROL

A. Testing:

   1. Topsoil:

      a. Test on-site, previously stripped topsoil that has been stockpiled for reuse and imported topsoil to certify that it meets the following requirements:

         1) Acidity Range: pH 5.0 to pH 7.0, inclusive.

         2) Percent Organic Matter:

            a) Test Method: Percent organic matter determined by loss on ignition of moisture-free samples dried in accordance with the current method of the AOAC Official Methods of Analysis of AOAC International

            b) Acceptance Criteria: Topsoil must contain at least 5 percent organic matter.

         3) Dry Weight Density: 95 pounds per cubic foot, minimum.

         4) Liquid Limit (Maximum): 65 as determined in accordance with AASHTO T 89.
5) Gradation Analysis: Provide topsoil with a gradation per Table 02910-1 located at the end of this Section.

b. Perform all topsoil testing at no increase in Contract Price, and submit test reports of the tests to the SEPTA Project Manager for approval.

c. If necessary, make the topsoil conform to the pH acidity range and percentage of organic matter listed in Subparagraphs 3.03A.1.a.1) and 3.03A.1.a.2).

1) All material unsuitable for use as topsoil becomes the property of the Contractor, and he must expeditiously remove it from the Site.

2. Humus:

a. Test the humus to verify that it meets the following requirements:

1) Acidity Range: pH 5.0 to pH 7.5 (intensity to acidity).

2) Moisture by Weight: 60-75 percent weight loss upon oven drying.

3) Water absorbing ability: 150 to 350 percent.

4) Percent Organic Matter:

a) Test Method: Percent organic matter determined by loss on ignition of moisture-free samples dried in accordance with the current method of the AOAC Official Methods of Analysis of AOAC International

(1) Dry the sample at 110 degrees Celsius prior to combustion.

b) Acceptance Criteria:

(1) Humus must contain at least 80 percent organic matter on a dry basis.

(2) Humus must contain at most 10 percent wood material, iron, and sulfur ash on a dry basis.

b. Perform all humus testing at no increase in Contract Price, and submit test reports of the tests to the SEPTA Project Manager for approval.
3. Soil Supplements:

a. After performing topsoil testing, determine the soil analysis and submit soil supplement recommendations to the SEPTA Project Manager for approval.

1) Prior to adding any soil supplements to the topsoil, take a sufficient quantity of topsoil samples to allow a representative analysis of on-site topsoil and imported topsoil from outside sources, if any.

2) Provide recommendations for both the grade and application rates of fertilizer and such other soil supplements as required.

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<thead>
<tr>
<th>Table 02910-1 Topsoil Gradation Analysis</th>
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<tbody>
<tr>
<td>Sieve Size</td>
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<td>2 inch</td>
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<td>Number 4</td>
</tr>
<tr>
<td>Number 10</td>
</tr>
<tr>
<td>Number 200</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 02936
SEEDING AND SOIL SUPPLEMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Requirements for seeding, mulching, and adding soil supplements to the topsoil.

B. Related Sections:

1. Section 01300 – Submittals.
2. Section 02910 – Topsoil.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO):


B. Association of Analytical Communities International (AOAC):

1. AOAC Official Methods of Analysis of AOAC International.

1.03 SUBMITTALS

A. Submit the following information for approval in accordance with the requirements of Section 01300:

1. Quality Assurance/Control Submittals:

   a. Design Data:

      1) Seeding Schedule per Subparagraph 1.07A.1.

   b. Certificates:

      1) Seed Certification per Subparagraph 1.04A.2.a.

      2) Soil Supplement Product Certification per Subparagraph 1.04A.3.a.
1.04 QUALITY ASSURANCE

A. Certifications:

1. Analysis and Standards:
   a. For standard products, include the manufacturer's certified analysis of the contents with each package.
   b. For other materials, provide analysis of the contents by a recognized laboratory performed in accordance with methods established in the AOAC Official Methods of Analysis of AOAC International, wherever applicable.

2. Seed Certification:
   a. Submit certificates or certifying tags indicating that lawn seed mixtures, seed purity percentages, seed germination percentage, and weed seed content percentages are in conformance with the Specifications.

3. Soil Supplement Product Certification:
   a. Submit either the manufacturer- or vendor-certified analysis for soil amendments and fertilizer materials.
   b. Submit certificates certifying the soil supplement products to have a guaranteed analysis in conformity with the SEPTA Project Manager approved laboratory soil supplement recommendations report.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver packaged materials to the Site as originally packaged in unopened containers with labels intact and legible showing the weight, analysis, and name of its manufacturer.

1. Provide new crop seed in sealed packages with proof that the correct mixture is enclosed, with the age indicated, and with certification that the material complies with applicable State regulations if required.

B. Store packaged products in a manner to prevent moisture damage and other forms of contamination.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
1. The following seasonal constraints govern when the Work of this Section can be performed, except that when environmental conditions warrant, the SEPTA Project Manager may extend the specified dates.

a. Allowable Seeding Dates:
   1) Spring: March 1 to June 1.
   2) Fall: August 1 to October 1.

2. Do not perform the Work of this Section when soil or weather conditions are unsuitable.

   a. Unsuitable conditions include moisture saturated or frozen in place soil and precipitation of any kind present or occurring during the Work.

   b. Sow seed mixtures when the air current is slow so that the mixture seeds the intended area and is not dispersed elsewhere.

B. Existing Conditions:

1. As part of the work specified under Section 02910, recommendations will be provided for both the grade and application rates of fertilizer and other soil supplements required to be added to the topsoil available for the Contract, whether new or existing at the Site.

1.07 SCHEDULING

A. Seeding Schedule:

1. Submit a proposed seeding schedule to the SEPTA project Manager that indicates the dates for performing each type of landscape work in various areas of the Site during normal seasons for such work.

   a. Once accepted, only revise schedule dates as approved in writing by the SEPTA Project Manager, and after submitting documentation of the reasons for the changes.

2. Proceed with, and complete landscape work as rapidly as portions of the Site become available, working within seasonal limitations for each kind of landscape work required.
1.08 MAINTENANCE

A. Duration:

1. Begin maintenance operations immediately after seeding is performed and continue them throughout construction and the warranty period.

   a. Maintenance includes weeding, applying mulch as needed, controlling insects and diseases, mowing grass, and performing other particular operations as specified.

B. Watering:

1. In seeded areas, keep the seed continually moist for proper germination, and maintain watering to prevent drying out or burning.

2. Thoroughly water established lawn areas at least bi-weekly and in a satisfactory manner during the construction period until Final Acceptance.

3. The Contractor will provide all necessary water access. The Contractor will provide all necessary hoses, and appurtenances.

C. Mowing:

1. Cut seeded areas at intervals required to maintain a maximum height of 2-1/2 inches.

PART 2 PRODUCTS

2.01 MATERIALS

A. Grass Seed:

1. Provide new crop seed, furnished in sealed packages evidencing proof that the correct mixture is enclosed, indicating the age of the seed, and showing compliance with applicable State regulations, if required. Provide seeds and mixtures as indicated in Tables 02936-1 and 02936-2, located at the end of this Section.
2. Raingarden/Swale Seed Mix to be provided by Ernst Conservation Seeds, 9006 Mercer Pike, Meadville, PA 16335, (800) 873-3321, or approved equal.
   a. Raingarden/Swale Seed Mix to be Mix Number: ERNMX-127 (Retention Basin Floor Seeding for Wildlife and Plant Diversity).

B. Mulching Material:
   1. Mulch Binder:
      a. Provide nonasphaltic emulsion mulch binder consisting of either a water soluble product consisting of a blend of vegetable gum and gelling/hardening agents, or a water soluble product consisting of hydrophilic polymers, viscosifiers, and sticking aids and gums.
      b. Asphalt emulsion binders are not acceptable.

C. Soil Supplement Materials:
   1. Lime:
      a. Provide natural dolomitic limestone containing not less than 85 percent of total carbonates with a minimum of 30 percent magnesium carbonates, ground so that not less than 90 percent passes a 10-mesh sieve and not less than 50 percent passes a 100-mesh sieve.

2. Aluminum Sulfate:
   a. Provide commercial grade aluminum sulfate.

3. Peat:
   a. Provide finely shredded sphagnum peat moss, consisting of 100 percent organic peat, brown in color, and suitable for horticultural purposes.
   b. Shredded particles may not exceed 1/4 inch in diameter.
   c. Peat, measured in air dry conditions, may not contain more than 35 percent moisture by weight.

4. Bonemeal:
   a. Provide commercial, raw, finely ground; bonemeal containing 4 percent nitrogen and 20 percent phosphoric acid.
5. Superphosphate:
   a. Provide a soluble mixture of treated minerals containing 20 percent available phosphoric acid.

6. Perlite:
   a. Provide perlite grades in accordance with Table 02936-3 located at the end of this Section.

7. Vermiculite:
   a. Provide horticultural grade vermiculite free of toxic substances.

8. Commercial fertilizer:
   a. Provide a complete fertilizer formula, in conformance with all requirements of the Pennsylvania Fertilizer Act of 1965 which governs the composition and manufacture of commercial fertilizer, and meeting the following requirements:
      1) Physical Composition: Uniform, dry, and free-flowing pellet or granular form.
      2) Nitrogen-Phosphate-Potash Ratios:
         a) 10-20-20.
         b) 0-20-20.
         c) Or approved equal.

2.02 EQUIPMENT

A. Lawn Roller:
   1. Furnish a cultipacker or similarly designed lawn roller weighing 60 to 90 pounds per linear foot of roller.

B. Watering Equipment:
   1. Furnish hose and other watering equipment required for the work.

PART 3 EXECUTION

3.01 PREPARATION

A. Tillage:
1. Till finish graded soil over the areas indicated to be lawn regardless of the type of lawn work to be performed.
   a. Use equipment and methods common to such work, and till the soil to a minimum depth of 2 inches.

B. Soil Supplements for Lawn Areas:

1. Add the recommended soil supplements for lawn areas as required according to the approved recommendations included with laboratory test reports for the topsoil required by Section 02910.
   a. These soil supplements may be incorporated into the soil during tillage operations.

3.02 APPLICATION

A. Seeding:

1. Not more than five days after soil supplements have been applied, sow seed mixtures in areas disturbed by construction as follows:
   a. For standard lawns, provide a grass mixture per Table 02936-1.

2. Sow the seeds over the areas indicated in two applications using hand or hydroseeding methods.
   a. If the hydroseeding method is used, both seeding and soil supplement may be applied together; however, the rates of application, methods, and equipment must be approved by the SEPTA Project Manager prior to using this method.

3. Sow one-half of the seed mixtures in one direction over the designated areas and the remainder at right angles to the first sowing.

4. Sow seeds at the following rates:
   a. Grass Seed Mixture: At rates specified in the seed tables.

B. Seed Cover:

1. Embed seed mixtures 1/4-inch into the topsoil using a light drag or rake, and moving in directions parallel to the contour lines.

2. Immediately after dragging or raking, compact the seeded areas using a lawn roller.
   a. Roll the seeded areas at right angles to existing slopes.
C. Lawn Mulching:

1. Not more than 48 hours after seeding, evenly apply lawn mulch over seeded areas.
   a. Start mulching at the windward side of relatively flat areas, or at the upper part of slopes.
   b. Spread mulch to provide total coverage to a depth not less than 1½ inches or more than 3 inches.

2. Immediately after spreading the mulch, either apply mulch binder to anchor the mulch to the soil, or secure the mulch by the peg and string method.
   a. To apply mulch binder, make up to three passes over the mulch as needed to firmly secure the mulch.
      1) Apply up to 10 gallons of binder per 1,000 square feet of seeded area.
   b. To secure the mulch by the peg and string method, drive stakes into the ground on 3 foot centers or less, and string binder twine in straight lines between adjacent stakes but diagonally crisscrossed over the mulch.
      1) After the twine is attached, drive the stakes nearly flush to the ground to draw the twine down and tight onto mulch.

3.03 REPAIR/RESTORATION

A. Reseed areas not promptly showing grass that has caught.
   1. Correct depressions and irregularities and reseed.
   2. Repeat correcting and reseeding until a complete coverage of grass is obtained.

B. Make repairs and replacements as required by SEPTA project Manager at no increase in Contract Price.

3.04 FIELD QUALITY CONTROL

A. Inspection:
   1. At the conclusion of maintenance periods, the SEPTA project Manager will inspect seeding work to determine if its condition is acceptable, or if repairs are required.
2. Any commercial fertilizer that becomes caked or otherwise damaged, making it unsuitable for use, will not be accepted.

3.05 PROTECTION

A. Protect seeded areas from washouts by using the methods specified in this Section.

1. Reseed or sod washouts and bare spots that develop from inadequate protection or otherwise until a healthy, complete coverage stand of grass is obtained.

B. Use temporary barricades to protect lawn areas or other areas from foot traffic until a healthy, total coverage stand of grass is obtained.

1. Barricade materials are subject to the SEPTA project Manager's approval.
**Table 02936-1 Standard Lawn Grass Mixture (Seed Mix #1) PennDOT Formula B**

<table>
<thead>
<tr>
<th>Formula and Species</th>
<th>Percent By Weight</th>
<th>Minimum Percent</th>
<th>Max. Percent Weed Seed</th>
<th>Seeding Rate (Lbs. Per 1000 SY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perennial Ryegrass Mixture (Lolium perenne). A combination of improved certified varieties with no one variety exceeding 50% of the total Ryegrass component.</td>
<td>20</td>
<td>98</td>
<td>90</td>
<td>0.15</td>
</tr>
<tr>
<td>Creeping Red Fescue or Chewings Fescue</td>
<td>30</td>
<td>98</td>
<td>85</td>
<td>0.15</td>
</tr>
<tr>
<td>Kentucky Bluegrass Mixture (Poa pratensis). A combination of improved certified varieties with no one variety exceeding 25% of the total Bluegrass component.</td>
<td>50</td>
<td>98</td>
<td>80</td>
<td>.20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>21.0</strong></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 02936-2 Raingarden/Swale Mix (Seed Mix #2)

<table>
<thead>
<tr>
<th>Seed Percentage</th>
<th>Species</th>
<th>Seeding Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>25%</td>
<td>Alopecurus arundinaceus (Creeping Foxtail)</td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td>Elymus virginicus (Virginia Wild Rye)</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>Carex vulpinoidea (Fox Sedge)</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>Agrostis scabra (Ticklegrass/Rough Bentgrass)</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td>Poa palustris (Fowl Bluegrass)</td>
<td></td>
</tr>
<tr>
<td>4%</td>
<td>Bidens cernua (Nodding Bur marigold)</td>
<td></td>
</tr>
<tr>
<td>3%</td>
<td>Sparganium eurycarpum (Giant Bur Reed)</td>
<td></td>
</tr>
<tr>
<td>3%</td>
<td>Verbena hastata (Blue Vervain)</td>
<td></td>
</tr>
<tr>
<td>2%</td>
<td>Juncus effuses (Soft Rush)</td>
<td></td>
</tr>
<tr>
<td>2%</td>
<td>Scirpus atrovirens (Green Bulrush)</td>
<td></td>
</tr>
<tr>
<td>2%</td>
<td>Scirpus cyperinus (Wool Grass)</td>
<td></td>
</tr>
<tr>
<td>2%</td>
<td>Scirpus polyphyllus (Many Leaved Bulrush)</td>
<td></td>
</tr>
<tr>
<td>1%</td>
<td>Mimulus ringens (Square Stemmed Monkey Flower)</td>
<td></td>
</tr>
<tr>
<td>1%</td>
<td>Solidago patula (Rough Leaved Goldenrod)</td>
<td></td>
</tr>
</tbody>
</table>

Raingarden/Swale Seed Mix to be applied at the rate of 15 lbs. per acre or ½ lb. to ½ lb. per 1000 square feet.

Seed Mix #3
### Table 02936-3 Standard Non Maintained Lawn Grass Mixture (Seed Mix #3)  
**PennDOT Formula W**

<table>
<thead>
<tr>
<th>Formula and Species</th>
<th>Percent By Weight</th>
<th>Minimum Percent</th>
<th>Max. Percent Weed Seed</th>
<th>Seeding Rate (Lbs. Per 1000 SY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tall Fescue (Festuca arundinacea var. Kentucky 31).</td>
<td>70</td>
<td>98</td>
<td>85</td>
<td>0.15</td>
</tr>
<tr>
<td>Birdsfoot Trefoil Mixture (Lotus corniculatus) A mixture of ½ Viking and ½ of either Empire, Norcen, or Leo.</td>
<td>20</td>
<td>98</td>
<td>80</td>
<td>0.10</td>
</tr>
<tr>
<td>Redtop (Agrostis alba)</td>
<td>10</td>
<td>92</td>
<td>80</td>
<td>0.15</td>
</tr>
</tbody>
</table>

**Total:** 21.0

### Table 02925-3 Perlite Gradation -Cumulative Percent Retained on Sieves

<table>
<thead>
<tr>
<th>Standard Sieve or Micron Size</th>
<th>Grade</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fine</td>
<td>Medium</td>
</tr>
<tr>
<td>+16 mesh or 1mm</td>
<td>10 percent maximum</td>
<td>60 percent maximum</td>
</tr>
<tr>
<td>+100 mesh or 150μm</td>
<td>60 percent minimum</td>
<td>85 percent minimum</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 03100
CONCRETE FORMS AND ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section covers the concrete formwork for construction of all concrete structures set forth on the Drawings and in these Specifications.

1.02 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI 347, Guide to Formwork for Concrete.

B. U.S. Department of Commerce Product Standards:
   1. PS-1-95, Construction and Industrial Plywood.

C. Western Wood Products Association: Western Lumber Grading Rules 98.


1.03 SUBMITTALS

A. Form Coating: Submit manufacturer's descriptive product data and current specification covering named product.

B. Form Ties: Submit manufacturer's descriptive product data, current specification covering named product.

1.04 QUALITY CONTROL

A. Formwork Design: Provide formwork designed to ensure the tolerances indicated and to include factors pertinent to safety of personnel during construction.

   1. Design formwork in accordance with American Concrete Institute's Guide to Formwork for Concrete, ACI 347, and in accordance with the following:
a. Design forms and falsework to include assumed values of live load, dead load, weight of moving equipment operated on formwork, temporary construction material, foundation pressures, stresses, lateral stability, and such other factors pertinent to safety of structure during construction.

b. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent construction.

B. Allowable Tolerances: Set and maintain concrete forms within tolerance limits stated in American Concrete Institute's Guide to Formwork for Concrete, ACI 347.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection:

1. Protect formwork materials before, during, and after erection to ensure acceptable finished concrete work. Also protect in-place materials and work of other trades in connection with concrete work.

2. In event of damage to erected forms, make necessary repairs or replacements prior to concrete pours. Perform such corrective work at no increase in Contract Price.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber:

1. Form framing, sheathing, struts, braces, and shoring in conformance with WWPA Grading Rules or SPIB Grading Rules.

2. Rough Structural and Dimension Lumber: Provide lumber of allowable species, surfaced four sides as applicable, and grade stamped with the appropriate WWPA or SPIB stamp indicating product compliance with PS-20-94.

3. Use lumber free of material defects that would deform the finished concrete product.

B. Plywood:

1. Form Sheathing and Panels: Not less than 5/8 inch thick Exterior Type B-B Plywood Class I and II conforming to U.S. Product Standard PS-1-95.
a. Use Class II only on surfaces not exposed to view.

C. Steel:

1. Metal Forms of a pre-engineered standard design, conforming to the concrete sections indicated on the Drawings, may be used in lieu of wood forms.

D. Form Ties:

1. Provide factory-fabricated, adjustable-length, removable or snap-off metal form ties conforming to ACI 347.

2. Use snap-off metal ties with ends that break at least 1½ inches from the face of the wall.

3. Do not use removable ties that leave holes larger than one (1) inch.

4. Do not use wire ties, flat bands or form ties fabricated on the project site.

5. Do not use wood spacers.

E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

PART 3 \ EXECUTION

3.01 SITE QUALITY CONTROL

A. Inspection:

1. Prior to placement of concrete, inspect forms for shape, location, and dimension of the concrete members being formed.
   
a. Provide lumber free of material defects that would unacceptably deform the finished concrete product or cause visible imperfections on surfaces exposed to public view.

2. Verify the items to be embedded are properly placed and anchored.

3. Upon removal of each concrete form, a review of the newly stripped surface shall be made before patching takes place.
4. Examine concrete surfaces following removal of forms to verify the surface does not contain residual form coating that will interfere with the other materials or coatings to be applied.

B. Non-Conforming Work

1. If formwork is found to be out of alignment, or requires residual or other detrimental material to be removed from the forms or pour area, realign the forms and/or remove the detrimental material from the formwork before pouring concrete into the form.

2. If detrimental form coating is found, use approved methods to remove it prior to applying other materials or coatings.

3.02 PREPARATION

A. Apply form coatings in accordance with manufacturer's specifications.

B. Do not allow excess form coating material to accumulate in the forms.

C. Do not allow form coatings to come in contact with construction joints and reinforcing steel.

3.03 ERECTION

A. General: Construct forms in accordance with ACI 347 to required dimensions, plumb, straight, mortar tight, and paste tight where appearance is important.

1. Securely brace and shore forms to prevent displacement, bowing and pillowing, and to safely support imposed concrete load.

2. Provide offsets, keyways, recesses, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and such other features as required. Use selected materials to obtain above requirements.

3. Fabricate forms for easy removal without hammering or prying against concrete surfaces.

4. Form intersecting planes to provide true, clean-cut corners with edge grain of plywood not exposed to concrete.

5. Build into forms, or otherwise secure in forms, items such as inserts, anchors, miscellaneous metal items, and such other embedded items as indicated on Drawings.

6. Wet forms sufficiently to prevent joints in wood forms from opening prior to concrete pour.
7. Do not use stay-in-place metal forms.

B. Openings: Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete.

1. Securely brace temporary openings and set tightly to forms to prevent the loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible consistent with the requirements of the work.

2. Provide openings in concrete formwork of the correct size and in the proper location to accommodate other items and operations of construction work passing through forms. Accurately place and securely support items to be built into forms.

C. Earth Forms: Earth forms are not permitted.

3.04 CONSTRUCTION

A. Form Removal

1. Remove forms in accordance with ACI 347 without damage to concrete and in a manner to ensure complete safety and serviceability of the structure.

   a. Do not cut form ties back from the face of the concrete.

   b. Concrete surface shall not contain residual form coating that will interfere with other materials or coatings to be applied.

   c. Concrete containing slag ground granulated blast furnace slag tends to develop strength slower then a concrete containing 100 percent Portland cement.

2. Do not remove supporting forms or shoring until the members have acquired sufficient strength to safely support their weight and the anticipated construction loads without distortion or excessive deflection. Consent to remove forms does not relieve the Contractor of the responsibility for the safety of the work.

3. When the atmospheric temperature at the site has been continuously above 50 degrees F. from the time of the pour, the forms shall be removed at the earliest practical time within the limits set forth in this paragraph, and wet curing shall continue without delay.

   a. Forms for walls and other vertical faces may be carefully removed 24 hours after the last portion of concrete in the
section involved has been placed, provided the concrete has sufficiently hardened to preclude damage resulting from form removal, and provided these members are not subjected to loads for a period of 14 days.

b. Maintain horizontal forms in place for a minimum of 14 days or until the concrete, as determined by job-cured cylinders, has attained a compressive strength of 3,000 p.s.i.

c. When a water-reducing retarder is used in the concrete mix, the normal time periods for removing forms may need to be increased.

4. When the atmospheric temperature at the site drops below 50 degrees F, leave all forms in place for at least 5 days regardless of the temperature within the protective covering or enclosure. Upon removal of forms, notify the Project Manager in order that a review of the newly stripped surfaces may be made before patching.

3.05 RE-USE OF FORMS

A. Forms for re-use shall meet new form requirements with respect to effect on poured concrete appearance and structural stability.

B. Do not delay or change the concrete pour schedule as a result of reusing forms compared to the schedule obtainable if all forms were new (in the case of wood forms) or if the total required forms were available (in the case of metal forms).

END OF SECTION
SECTION 03200
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 DESCRIPTION
A. The work specified in this Section consists of furnishing and installing reinforcement for concrete structures.

1.02 RELATED WORK
A. Section 01300: Submittals.
B. Section 03300: Cast-In-Place Concrete.
C. Section 03400: Precast Concrete.

1.03 REFERENCES
A. American Concrete Institute (ACI):
   1. ACI 315; Details and Detailing of Concrete Reinforcement.
   2. ACI 318-08; Building Code Requirements for Reinforced Concrete.
B. ASTM International (ASTM):
   1. ASTM A82; Specification for Cold-Drawn Steel Wire for Concrete Reinforcement.
   2. ASTM A185; Specification for smooth Welded Steel Wire Fabric for Concrete Reinforcement.
   3. ASTM A615; Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement, including Supplementary Requirements.
   4. ASTM A663; Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
   5. ASTM A767; Specification for Zinc – Coated (Galvanized) Steel Bars for Concrete Reinforcement.
   6. ASTM A775; Specification for Epoxy – Coated Reinforcing Bars.

1.04 SUBMITTALS

A. Shop Drawings and Product Data:

1. Prepare shop drawings of concrete reinforcement in accordance with American Concrete Institute's ACI 315.

2. Provide drawings showing all fabrication dimensions and locations for placing reinforcement and bar supports; indicate bending diagrams, splicing and lap of rods, shapes, dimensions and details of bar reinforcing and accessories.

B. Test Reports:

1. Submit copies of reports showing the results of tests, conducted in accordance with the American Society for Testing and Materials Specifications.

2. Test Requirements may be waived based upon certified copies of mill test reports.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials:

1. Store reinforcing materials in a manner to prevent excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.

2. Identify bundles of reinforcing steel with tags wired to steel.

1.06 PROJECT CONDITIONS

A. Protection: Protect in-place reinforcement from excessive construction traffic and other work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Reinforcing Steel:

1. Reinforcement Bars: ASTM A615, Grade 60, deformed steel, which shall satisfy the exceptions in ACI Building Code, AASHTO, and Federal Specifications.
a. Epoxy-Coated (when indicated): ASTM A775

1) ASTM A775; Section 4 – Materials. Add the following sentence in NOTE 3: “Steel reinforcing bars exhibiting any sliver-like defects after the heating and coating process, will be rejected unless satisfactorily repaired.”

2) Section 10 – Permissible Coating Damage and Repair of Damaged Coating. Add the following sentence to sub-article 10.2: “Repair by mechanical wire brush cleaning and painting with an approved epoxy paint using the paint manufacturer’s approved procedure. Repair any bars with signs of rust. Do not use bars with greater than 5% damage on the total bar surface area.”

b. Zinc-Coated (Galvanized) (when indicated): ASTM A767

1) Zinc-coated reinforcing steel for structures shall be hot-dip galvanized in accordance with ASTM A767, Class II two ounces per square foot with a minimum thickness of 3.5 mils.

2) Bars shall be galvanized after fabrication.

3) Reinforcing steel produced by Thermex method (water quenching) shall not be used.

B. Wire: ASTM A82.


E. Rebar Splicing Coupler: A two-piece splicing system manufactured from ASTM A615 Grade 60 deformed rebar. A dowel bar splicer with integral nailing flange shall be threaded for a threaded down-in rebar such that the completed splice exceeds the tensile requirements of ACI 318.

1. Internal Coupler Protector: Provide coupler manufacturer’s plastic internal coupler protector where couplers are provided for anticipated future additions.

2. Bar End Protectors: Plastic solid sleeve for placement over bar ends to protect threading from damage, contamination, and rust.
3. Use Rebar Splicing Coupler only where shown on Drawings or where approved by the Project Manager.

4. Acceptable Manufacturers:
   a. Richmond Screw Anchor Co.
   b. Dayton Superior.
   c. Or approved equal.

F. Dowel Bars (for shear transfer in pavement slabs)
   1. Plain round bar conforming to requirements of ASTM A663, Grade 70, 75 or 80 which is not burred, roughened or deformed out-of-round so slippage is not hindered.
   2. Coat with curing compound to render surface bondless.
      a. Curing compound: Section 03300.

2.02 FABRICATION

A. General: Fabricate reinforcement to the dimensions indicated on the Drawings and within the tolerances given in ACI 315. Perform bending of steel reinforcement by the cold bending method.
   1. Do not use bars with kinks or bends not indicated on Drawings.
   2. Perform bar shape fabrication in a manner that will not injure the material or lessen the member strength.
   3. Use a designed bending machine, either hand- or power-operated.
   4. Do not field bend bars partially embedded in concrete unless approved by the Project Manager.

B. Coating of reinforcement shall be implemented as follows:
   1. Zinc-coated (galvanized) reinforcement shall be implemented in all exterior concrete slab-on-grade elements, at grade sidewalks, and all other concrete elements defined in the Civil drawings. Additionally, galvanized reinforcement shall be implemented in all field-installed structural concrete elements, including but not limited to; cast-in-place walls, interior slabs-on-grade, elevated cast-in-place slabs, and all structural foundations.
   2. Epoxy-coated reinforcement- May be implemented in all precast elements in lieu of galvanized reinforcement.
PART 3 EXECUTION

3.01 INSPECTION

A. Notify Project Manager 48 hours before placing concrete so he can inspect placement of metal reinforcement.

3.02 INSTALLATION

A. Placing:

1. Place metal reinforcement accurately and securely brace against displacement within permitted tolerances and in accordance with ACI 318 through the use of reinforcing accessories.

2. Terminate reinforcement two inches from face of expansion joints.

3. Continue reinforcement across or through construction joints.

4. When obstructions interfere with the placement of reinforcement, pass such obstructions by placing reinforcing around it. Do not bend the reinforcing to clear the obstructions.

5. Install welded wire fabric as indicated, lapping joints eight inches and wiring securely. Extend welded wire fabric to within two inches of sides and ends of slabs.

6. Do not lay metal reinforcement on formwork.

7. Place slab reinforcement supported from the ground on concrete blocks of the correct height and having a compressive strength equal to or greater than the specified compressive strength of concrete being placed. Use concrete blocks not larger than 3 inches by 3 inches with a height equal to required bottom steel cover.

8. Reinforcement supported from formwork for slabs and beams not exposed to weather or to a continuous wet environment may use bar chairs made of plastic or metal. Use stainless steel boosters in areas exposed to a wet environment.

9. Place additional reinforcement around openings in slabs and walls as detailed on the Drawings.

B. Splicing:

1. Splice metal reinforcement as indicated on the Drawings and in accordance with ACI 318.
2. Welding of crossing bars (tack welding) is not permitted.

3. Secure metal reinforcement at intersections with not less than No. 16-gauge annealed wire or appropriate size clips. When bar spacing is less than 12 inches, tie alternate intersections.

4. Make mechanical butt splices in accordance with rebar splicing coupler manufacturer’s installation instructions.

5. When epoxy coated reinforcement bars are being spliced using a mechanical splice system, coat the entire splice area with compatible epoxy paint after the system is assembled.

C. Dowel Bar Installation: Install one-half the length of coated bar dowel into slab to be poured.

D. Cleaning: Clean or otherwise protect metal reinforcement so that at the time concrete is placed, reinforcement is free from rust, scale, or other coatings that will destroy or reduce bond.

E. Concrete Reinforcement Protection:

1. Provide protection for reinforcement during concrete pours in accordance with ACI 318, unless indicated otherwise on the Drawings.

F. Field Repair of Coated (Zinc – Galvanized) Bars: The contractor shall be required to field repair damaged areas of the bar coating and to replace bars exhibiting severely damaged coatings. Field repair material shall have a minimum 65% zinc by weight. Thickness of repair shall not be less than 3.5 mils.

3.03 SITE QUALITY CONTROL

A. The Testing and inspection Agency must perform field inspections and prepare reports.

1. Written reports on all tests and inspections shall be provided immediately after work is performed. The reports shall state tests and inspection observations comply with requirements or deviate from them.

B. Advise the Testing and Inspection Agency sufficiently in advance of concrete placement to provide sufficient time to schedule an inspection of the concrete reinforcement.

C. Prior to placement of concrete, inspect the reinforcement size, location, spacing, and clear distance between bars and to the outside of the
concrete; verify placement is correct per contract drawings and reinforcement will not be displaced during the placement of concrete.

END OF SECTION
SECTION 03300
CAST-IN-PLACE CONCRETE

PART 1   GENERAL

1.01 SECTION INCLUDES

A. The work specified in this Section consists of designing mix, furnishing, placing, and curing Portland Cement concrete, reinforced and unreinforced, as indicated.

1.02 RELATED WORK

A. Section 01300: Submittals.

B. Section 01410: Testing and Inspection Services.

C. Section 03100: Concrete Formwork.

D. Section 03200: Concrete Reinforcement.

E. Work Provided Under Other Contracts: Items to be embedded in concrete are as specified in the various Sections of this Contract and other Contracts for this Project. The responsibility for coordinating concrete pours with embedded items rests solely with the Contractor.

F. Work Specified Under Other Sections: Items to be embedded in concrete are as specified in the various Sections of this Contract Specification. The responsibility for coordinating concrete pours with embedded items rests solely with the Contractor.

1.03 REFERENCES

A. Abbreviations and Acronyms:

1. \( F_F \): Flatness F-number.

2. \( F_L \): Levelness F-number.

3. VOC: An acronym for volatile organic compounds, generally meant to refer to organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere.

B. Definitions:

1. Cementitious Material: Mixture of cement and one type of a cement replacement material.
2. Flatness F-Number ($F_F$): A dimensionless number that defines the relative smoothness of a floor slab.

3. Levelness F-Number ($F_L$): A dimensionless number that defines the relative conformity of a floor surface to a horizontal plane.

C. Reference Standards:

1. American Association of State Highway and Transportation Officials, AASHTO M 182 Burlap cloth made from Jute or Kenaf.

2. American Concrete Institute (ACI):
   a. ACI 117/117R; Standard Specifications for Tolerances for Concrete Construction and Materials.
   b. ACI 211.1; Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete-Procedure for Mix Design.
   c. ACI 211.2; Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
   d. ACI 301; Specifications for Structural Concrete.
   e. ACI 302.1R; Guide for Concrete Floor Slab Construction
   f. ACI 302.2R; Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
   g. ACI 304R; Guide for Measuring; Mixing, Transporting and Placing Concrete.
   h. ACI 304.2R; Placing Concrete by Pumping Methods.
   i. ACI 305R; Hot Weather Concreting.
   j. ACI 306R; Cold Weather Concreting.
   k. ACI 308R; Guide to Curing Concrete.
   l. ACI 318/318R; Building Code Requirements for Structural Concrete and Commentary.
   m. ACI 350R; Code Requirements for Environmental Engineering Concrete Structures and Commentary.

3. American Institute of Steel Construction (AISC):

4. ASTM International (ASTM):
   a. ASTM C31/C31M; Standard Practice for Making and Curing Concrete Test Specimens in the Field.
   b. ASTM C33; Standard Specification for Concrete Aggregates.
   d. ASTM C42/C42M; Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   e. ASTM C78; Standard Test Method for Flexural Strength Concrete (Using Simple Beam with Third-Point Loading).
   g. ASTM C138/138M; Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
   h. ASTM C143/143M; Standard Test Method for Slump of Hydraulic-Cement Concrete.
   i. ASTM C150; Standard Specification for Portland Cement.
   l. ASTM C171; Standard Specification for Sheet Materials for Curing Concrete.
   m. ASTM C172; Standard Practice for Sampling Freshly Mixed Concrete.
   n. ASTM C173/C173M; Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
   o. ASTM C192/C192M; Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
p. ASTM C231; Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

q. ASTM C260; Specification for Air-Entraining Admixtures for Concrete.

r. ASTM C260; Standard Specification for Air-Entraining Admixtures for Concrete.

s. ASTM C309; Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

t. ASTM C494/C494M; Standard Specification for Chemical Admixtures for Concrete.

u. ASTM C618; Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.


w. ASTM C882; Standard Test Method for Bond Strength of Epoxy-Resin Systems Used With Concrete by Slant Shear.

x. ASTM C989; Standard Specification for Slag Cement for Use in Concrete and Mortars.


z. ASTM C1116/C1116M; Standard Specification for Fiber-Reinforced Concrete.

aa. ASTM C1315; Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.


dd. ASTM D751; Standard Test Methods for Coated Fabrics.


gg. ASTM D1709; Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.

hh. ASTM D1752; Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.


kk. ASTM E154; Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

ll. ASTM E329; Specification for Agencies Engaged in the Testing and/or Inspection of Materials used in Construction.

mm. ASTM E1155; Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

nn. ASTM E1643; Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

oo. ASTM E1745; Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

5. United States Government:

a. Environmental Protection Agency (EPA):
   1) 40 CFR 51; Requirements for Preparation, Adoption, and Submittal of Implementation Plans.

6. U.S. Army Corps of Engineers Specifications (USACE):

a. USACE CRD-C 572; Specification for Polyvinylchloride Waterstop.

7. National Ready Mixed Concrete Association (NRMCA):
1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Before concrete is to be placed, give a 10-day advance notice to those performing other construction work related to the concrete pours, such as to those performing work that must be supported by or embedded in concrete, to allow such items to be introduced or furnished before the concrete is placed.

2. Coordinate with the Independent Quality Assurance Testing and Inspection Agency to insure notification is received sufficiently early to allow them ample time to schedule and perform the required testing and inspection.

B. Pre-Installation Meetings:

1. Prior to placement of concrete, convene an onsite meeting to establish and coordinate procedures that will enable the Contractor to provide the best possible product under anticipated field conditions.

2. Required attendees to this meeting include representatives of organizations and material suppliers involved with the design and construction of concrete elements.

C. Scheduling:

1. A minimum of 30 days prior to placing concrete, submit a schedule showing proposed construction methods, construction joint locations, and the sequence of pouring for approval.

1.05 SUBMITTALS

A. Product Data: Submit manufacturer’s descriptive product data and current specifications for the concrete accessories specified herein (admixtures, joint fillers, curing materials, floor hardeners, waterstops, etc.). Include installation instructions.

B. Samples: Submit samples of materials being used when requested by the Project Manager including names, sources, and descriptions.
C. Design Mix: Prior to production of concrete, submit for approval, on form attached at the end of this Section, all mix designs proposed for project. Include with the mix design a standard deviation analysis or trial mixture test data in accordance with ACI 301 Section 4. Use materials in such proposed design mix as specified herein. Make such adjustments in the proposed design mix as directed by the Engineer. Make such adjustments at no increase in contract price.

1. Water shall not be added to concrete mix at the project site unless it is withheld from the mix at the batch mixing plant. Indicate amounts of mix water to be withheld for later addition at project site. If water is added to mix at the Site, perform additional revolutions at the mixing speed to adequately incorporate the additional water into the mixture.

2. For High-Early Strength Concrete, provide an air-entrained mixture that attains a 24-hour compressive strength of 2,500 psi and a three (3) day strength of 3,500 psi. Data shall be provided to demonstrate the ability of the mixture to meet the specification requirements.

D. Test Reports:

1. Submit concrete test reports specified in Part 3 of this Specification.

E. Certificates:

1. Furnish the Project Manager and local authorities requiring same, certificates originated by the batch mixing plant certifying ready mixed concrete, as manufactured and delivered, to be in conformance with ASTM C94.

F. Delivery Tickets: A delivery ticket shall accompany each load of concrete from the batch plant.

1. Tickets must be signed by the Contractor's representative, noted as to time and place of pour, and kept in a record at the site. Make such records available for inspection upon request by the Project Manager.

2. Information presented on the ticket to include the tabulation covered by ASTM C94, Section 16, as well as any additional information the local codes may require.

G. Schedule: Submit schedule showing methods, construction joint locations, and sequence of pouring a minimum of 30 days prior to placing concrete.
H. Independent Testing and Inspection Agency (Approved Agency) shall submit inspection and testing reports required by this specification.

I. Submit samples not less than 12 inches by 12 inches in size of each type of sandblast finish required, indicating materials and methods used to produce the finish.

1.06 QUALITY ASSURANCE


B. Source Quality Control:

1. Laboratory Tests: Materials stated herein require advance examination or testing according to methods referenced, or as required by the Project Manager.

2. Compression Test Cylinders: For laboratory trial batches, make in accordance with American Concrete Institute ACI 301. Test to consist of three compression test cylinders for each class of concrete with one broken at seven days and two broken at 28 days; ASTM C192 and ASTM C39.

3. Site Mock-up: Provide site mock-up, at least 3 feet by 3 feet in size, showing finish texture and color for exposed concrete surface.
   
   a. The number of mock-up panels required shall be the number necessary to obtain the approval for color and texture of panel.

   b. The approved mock-up shall be used as the standard for the aesthetic quality of the surface finish; it shall be the Control Sample.

4. Requirements of Regulatory Agency: Comply with air pollution regulations of the local area for sand-blasting activities and operations.

   a. Minimize the drift of dust and blast material as much as possible thru the use of containing devices.

   b. Clean up and remove, at the end of each day, the waste material from the general work area.
1.07 PROJECT CONDITIONS

A. ACI Compliance: Cast-in-place concrete work shall conform to ACI 301 except as modified by these Specifications or the Drawings.

B. Concrete Encasement of Pipes: Encase pipes under structures and buildings indicated by the Drawings to be encased in concrete for the full length of the pipe run under the structure.

C. Concrete Encasement of Conduits: Encase conduit runs as indicated and detailed on the Drawings as work of Division 16 - Electrical Sections.

D. Equipment Bases: Construct reinforced concrete bases for equipment and piping under this contract at no increase in contract price.

E. The use of High-Early Strength Concrete mix (as defined by requirements in this Section) shall only be installed at locations given approval by the Engineer.

1.08 SEQUENCING

A. Where other construction work is relative to concrete pours, or must be supported by or embedded in concrete, those performing such related work must be given 10 days’ notice to introduce or furnish embedded items before concrete is placed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement:

1. Portland Cement: ASTM C150 of the following Type:

a. Type I, Normal.

b. Type II, Moderate Sulfate Resistance.

2. Only one brand and manufacturer of approved cement shall be used for exposed concrete.

3. Cementitious material is a mixture of cement and one type of a cement replacement material.

B. Cement Replacement Materials:

1. Ground Granulated Blast-Furnace Slag (GGBFS): Conforms to ASTM C989, Grade 120. Use GGBFS at the rate of 25% to 35% by weight of the total cementitious material.
2. **Fly-Ash:** Conform to ASTM C618 Type F.
   
a. Maximum rate of 15% to 25% by weight of total cementitious material.

b. Maximum Loss of Ignition: Not to exceed 4%.

3. Provide only one type of cement replacement material for entire project. The material selected shall be obtained from one source.

**C. Normalweight Concrete Aggregates:** Process aggregate meeting requirements of ASTM C33 and subject to the following limitations.

1. **Coarse Aggregate Size:** Maximum size of coarse aggregate shall not exceed the following requirements but in no case larger than 1½ inches.
   
a. One-fifth narrowest dimension between sides of forms within which concrete is to be cast.

b. Three-fourths of the minimum clear spacing between reinforcing bars.

c. One-third the slab thickness for unreinforced slabs.

2. Reduced aggregate concrete containing aggregate with particle size not less than 1/8 inch nor more than 1/2 inch in any dimension and a maximum of 5 percent of particles passing a No. 8 sieve (for use in metal pan stairs only).

**D. Water:** Clean and free from injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances that may be deleterious to concrete or reinforcement.

**E. Concrete Admixtures:**

1. **Prohibited Admixtures:** Use only non-corrosive, non-chloride admixtures.

2. Provide admixtures produced and serviced by established, reputable manufacturers and use in compliance with manufacturer's recommendations.

3. **Air-Entraining Admixture:** Use a product conforming to requirements of ASTM C260.
4. Water-Reducing Admixture: Use a product conforming to requirements of ASTM C494/C494M, Type A. (Use this for all concrete except where an admixture listed below is used).

   a. Acceptable Manufacturers:
      1) Eucon WR-75; The Euclid Chemical Company.
      2) Pozzolith 220N; BASF The Chemical Company.
      3) Plastocrete 161; Sika Corporation.
      4) Or approved equal.

5. Water-Reducing and Retarding Admixture: Use a product conforming to requirements of ASTM C494/C494M, Type D.

   a. Acceptable Manufacturers:
      1) Eucon Retarder-75; The Euclid Chemical Company.
      2) Pozzolith 100XR; BASF The Chemical Company.
      3) Plastiment; Sika Corporation.
      4) Or approved equal.

6. Water-Reducing and Acceleration Admixture: Use a product conforming to requirements of ASTM C494/C494M, Types C or E.

   a. Acceptable Manufacturers:
      1) Accelguard 80; The Euclid Chemical Company.
      2) Pozzutec 20; BASF The Chemical Company.
      3) Plastocrete 161 FL; Sika Corporation.
      4) Or approved equal.

7. High-Range, Water-Reducing Admixture: Use a product conforming to requirements of ASTM C494/C494M, Type F.

   a. Acceptable Manufacturers:
      1) Eucon 1037; The Euclid Chemical Company.
      2) Glenium; BASF The Chemical Company.
3) Sikament 610; Sika Corporation.
4) Or approved equal.

8. Store admixtures in a manner to prevent contamination, evaporation, moisture penetration, or damage. Do not use products which have been stored longer than 6 months.

9. Prior to the mix design review by the Project Manager, provide written conformance to the specified requirements of the admixture.

10. Corrosion Inhibitor (for platforms, deck of overpass, stairs, ramps, and low-level platforms): Use a product conforming to requirements of ASTM C494/C494M, Type C.
   a. Follow manufacturer’s recommendations for dispensing admixture into concrete mix.
   b. Mix water adjustment is essential to account for water in corrosion inhibitor to maintain required water/cementitious ratio.
   c. Acceptable Manufacturers:
      1) DCI or DCI S; Grace Construction Products.
      2) FerroGard®-901; Sika.
      3) Or approved equal.

F. Preformed Expansion Joint Fillers:

1. Nonextruding and Resilient Bituminous Types (for exterior use in pavements and sidewalks only): ASTM D1751.
4. Acceptable Manufacturers:
   a. The Euclid Chemical Company/Tamms Industries, Inc.
   b. W.R. Meadows, Inc.
   c. APS Supply Company.
   d. Greenstreak
G. **Vinyl Waterstops:** Ribbed type manufactured from virgin polyvinyl chloride plastic compound conforming to U.S. Army Corps of Engineers CRD-C 572.

1. **Construction Joint:** Flat ribbed 6 x 3/8 inch; such as Vinylex Corporation; Cat. No. R6-38.

2. **Expansion Joint:** Ribbed center bulb 9 x 3/8 inch; center bulb of 1 inch minimum to 1 1/2-inch maximum outside diameter such as Vinylex Corporation. Cat. No. RLB9-38.

3. **Acceptable Manufacturers:**
   a. Vinylex Corporation (Catalog Nos. as specified above).
   b. The Euclid Chemical Company/Tamms Industries, Inc.
   c. Greenstreak, Inc.
   d. Or approved equal.

4. **Retro-fit waterstop:** 6 x ⅜-inch with 3 3/16-inch T-leg such as Greenstreak Product No. 609 or approved equal.

H. **Surface Applied Waterstop:** A specially formulated joint sealant which swells upon contact with water. Provide waterstop packaged in continuous length coils. Material composition as follows:

1. Chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties.

2. Waterstop shall have a coating formulated to inhibit initial expansion due to moisture presence in the fresh concrete.

3. **Size:** Dual extrusion design; 10 mm by 20 mm.

4. Waterstop shall be secured to hardened concrete with the waterstop manufacturer’s standard adhesive binder.

5. **Acceptable Manufacturers:**
   a. Greenstreak; Hydrotite CJ.
   b. ADEKA; Ultraseal.
   c. Vinylex, Swellseal 2010
d. EXPAND-Tite; Durajoint Concrete Accessories

e. Or equal.

I. Curing Materials: Use curing materials that will not stain or affect concrete finish or lessen the concrete strength and comply with the following requirements:

3. Liquid Curing Compound.
   a. Use material meeting the requirements of ASTM C309, Type 1 which are nontoxic and free of taste, odor, and complies with low VOC requirements.
   b. Where a finish material is to be applied over concrete with architectural finish, provide certification by the product manufacturer stating the curing compound as non-detrimental to the bond of the finish material.
   c. Ensure curing compound is compatible with future concrete coatings and surface treatments.
   d. Acceptable manufacturers:
      1) L&M Cure; L&M Construction Chemicals, Inc.
      2) Masterkure, BASF The Chemical Company.
      3) Kurez DR, Euclid Chemical Company.
      4) Or approved equal.

J. Epoxy Bonding Compound: A high-modulus, low-viscosity, moisture-insensitive epoxy adhesive conforming when mixed to the requirements of ASTM C881, Type II, Grade 2, Classes B and C having the following properties:

1. Compressive Strength (Minimum): 8,000 psi at 28 days when measured in ASATM D695;

2. Tensile Properties:
   a. Tensile Strength (Minimum): 4,000 psi. at 14 days when measured in accordance with the requirements of ASTM D638.
b. Elongation at Break: One to three percent when measured in accordance with the requirements of ASTM D638.

c. Modulus of Elasticity: $3 \times 10^5$ psi when measured in accordance with the requirements of ASTM C882.

3. Bond Strength, ASTM C882:

a. Plastic concrete to hardened concrete at 14 days (moist cure): 1,700 psi. min.

4. Acceptable Manufacturers:

a. Sikadur 32 Hi-Mod; Sika Corporation.

b. Euco Epoxy #452 MV or #620; Euclid Chemical Company.

c. Fosroc, Inc.; Notobond 881

d. Or approved equal.

K. Epoxy Adhesive (for grouting dowels): Provide a moisture-insensitive epoxy adhesive of thick (gel) consistency conforming to the requirements for Type IV, Grades 2 and 3; Classes A, B, and C, except for gel times, as specified in ASTM C881/C881M; complying with the requirements for Type IV Grade 3, Class A, B, and C except for gel times as specified in AASHTO M 325, Type IV Grade 3, Class A, B, and C except for gel times, and having the following properties:

1. Compressive Strength (Minimum): 10,000 psi. min. at 28 days when measured in accordance with the requirements of ASTM D695.

2. Tensile Properties:

a. Tensile Strength (Minimum): 3,000 psi at 14 days when measured in accordance with the requirements of ASTM D638.

3. Minimum Bond Strength (Hardened Concrete to Hardened Concrete) 2000 psi at 14 days (moist cure) when measured in accordance with the requirements of ASTM C882.

4. Mixed epoxy resin adhesive shall conform to ASTM C881, Type I, Grade 3, Class B and C.

5. Acceptable Manufacturers:

a. Hit-RE 500-SD; Hilti.
b. Simpson Set XP; Simpson Anchors.

c. Or approved equal.

L. Non-Slip (Dry-Shake) Aggregate Surfacer:

1. Provide aluminum-oxide, non-slip aggregate surfacer to be applied to fresh concrete by the dry shake method.

2. Acceptable manufacturers:

   a. Fristex\textsuperscript{®} NS, BASF The Chemical Company.

   b. Approved equal.

M. Penetrating Sealer

1. Provide a solvent-free concentrate of silane modified siloxane emulsion.

2. Acceptable Manufacturers:

   a. Sikagard\textsuperscript{®} 701W Penetrating Sealer.

   b. Or approved equal.

N. Construction Joint Device: Integral galvanized steel formed to tongue and groove profile for slab-on-grade construction.

1. For exposed concrete areas, provide plastic joint cap strip that can be removed for placement sealant.

2. Acceptable Manufacturers:

   a. Heckman Building Products, Inc.

   b. Or approved equal.

O. Contraction Joint Insert: Two-piece plastic preassembled preformed contraction joint; depth of embedment equal to 1/4 of the slab thickness.

1. Acceptable Manufacturers:

   a. W.R. Meadows: SPEED-E-JOINT\textsuperscript{®}.

   b. Or approved equal.

P. Construction and Control Joint Filler for Slab-on-Grade: A two-component epoxy joint filler.
1. Acceptable Manufacturers:
   a. Sika Corporation: Sikadur 51 SL.
   b. Euclid Chemical Company: Euro 700.
   c. Master Builders: Masterfill® 300.
   d. Or approved equal.

Q. Vapor Barrier:
   1. Provide black, 3-ply, high-density, polyethylene vapor barrier reinforced with nylon cords and having the following properties:
      a. Classification: ASTM E1745 Class C.

2. Acceptable manufacturers:
   a. Stego Wrap Vapor Barrier, STEGO Industries, LLC.
   b. Griffolyn Type 65, Reef Industries, Inc.
   c. Dura Skrim 8BB, Raven Industries.
   d. Approved equal.

### 2.02 MIXES

A. Selection of Proportions of Normal Weight Concrete: ACI 211.1.

B. Proportions of Ingredients: Establish proportions, including water-cement ratio on the basis of either laboratory trial mixture tests or standard deviation analysis, with the materials specified herein.

   1. Laboratory Trial Mixture Test: ACI 301, Section 4 and ACI 318, Section 5.
   2. Standard Deviation Analysis: ACI 301, Section 4 and ACI 318, Section 5.

C. Classes of Concrete:

   1. Class A: 4,500 psi minimum compressive strength at 28 days; 564 pounds per cubic yard minimum cementitious material content.
   2. Class B: 3,000 psi minimum compressive strength at 28 days; 517 pounds per cubic yard minimum cementitious material content.
3. Class C: 2,000 psi minimum compressive strength at 28 days; minimum cement content per cubic yard in accordance with current ready-mix plant standard practice.

4. High-Early Strength Concrete: 3500 psi compressive strength at 3 days; 640 pounds per cubic yard minimum cementitious material.

D. Specified Flexural Strength at 28 Days:
   1. Class A: 603 psi

E. Water-Cementitious Material Ratio:
   1. Class A Concrete shall have a maximum water- cementitious material ratio of 0.45.
   2. Class B Concrete shall have a maximum water- cementitious material ratio of 0.55.
   3. Proportion Class C Concrete to meet the strength requirement.
   4. High-Early Strength Concrete shall have a maximum water- cementitious ratio of .43.

F. Slump:
   1. Concrete, at the point of delivery, shall have a slump of 4 inches (± 1 inch) as determined by ASTM C143; slump value may be increased 1 inch for methods of consolidation other than vibration.
   2. Pumped concrete shall have a maximum slump of 5 inches measured prior to pumping.
   3. Concrete containing high-range water-reducing admixture shall have an 8-inch maximum slump after admixture is added to concrete with a 2- to 4-inch slump.

2.03 ADMIXTURES

A. Air Entraining: Provide air-entrained concrete for each concrete pour except where indicated otherwise on the Drawings or specified herein. Total air content required as follows:

1. Maximum-size coarse aggregate, inches: Air content percent by volume:
   1½       5 ± 1
   3/4 or 1  6 ± 1
B. Water-Reducing Admixture: Unless high temperatures occur or placing conditions dictate a change, use concrete containing a water-reducing admixture.

C. Water-Reducing and Retarding Admixture: When high temperatures occur or placing conditions dictate, the water-reducing admixture (Type A) may be replaced with a water-reducing and retarding admixture (Type D). Notify the Engineer of such change and submit product data prior to placement of concrete.

D. Water-Reducing and Accelerating Admixture: When low temperatures occur or placing conditions dictate, the water-reducing admixture (Type A) can be replaced with a water-reducing and accelerating admixture (Type C or E). Notify the Engineer of such change and submit product data prior to placement of concrete.

2.04 Source Quality Control

A. Laboratory Tests: Materials stated herein require advance examination or testing according to methods referenced, or as required by the Engineer.

B. Compression Test Cylinders: For laboratory trial batches, make in accordance with American Concrete Institute ACI 301.

C. Flexural Strength Beams: For laboratory trial batches, make in accordance with American Concrete Institute ACI 301. Test to consist of three flexural strength beams (6 x 6 inches) for Class A concrete only, with one broken at seven days and two broken at 28 days; ASTM C192 and ASTM C78. Perform this test for vehicle pavement slabs only.

D. Coordination of Other Tests and Inspections:
   1. Notify the code-required Approved Agency responsible for performing special inspections when concrete for this Contract is being mixed, placed, and/or tested.
   2. Cooperate with the code-required Approved Agency when they are performing required material verifications and other special inspections, and provide full access to the work.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect work to receive cast-in-place concrete for deficiencies which would prevent proper execution of the finished work. Do not proceed with placing until such deficiencies are corrected.
B. Verify survey of erected structural frame (defined in Section 05 12 00), listing top of steel elevations, has been performed for elevated slab support systems.

1. Use survey to determine any potential levelness issues related to concrete placement tolerance requirements listed in Subparagraph 3.03D.3.

3.02 PREPARATION

A. Joints

1. General: Only the location of critical joints throughout the structures are indicated on the Drawings.

a. Subject to the Engineer’s approval, select additional joint locations in walls, slabs, beams, and footings as required.

1) Submit requests for approval of joint locations a minimum of 30 days prior to scheduled concrete pours.

2) Do not make concrete pours unless joint locations have been approved by the Engineer.

3) No exceptions are permitted to the specified requirements for joints unless written approval is given by the Engineer.

b. Place walls and slabs in alternate sections allowing at least two days elapsed time before concrete is placed against an adjacent vertical joint.

2. Construction Joints in Walls and Foundations: Placement of additional joint locations shall meet the following:

a. Locate such joints to least impair the strength of the structure.

b. The horizontal length between joints in footings and grade beams shall not exceed 60 feet.

c. The horizontal length between wall joints shall not exceed 30 feet in a continuous wall. At corners or other intersections of two or more walls, provide a joint in each wall at a distance less than 15 to 20 feet from the intersection point in all directions.
1) Align joints with those placed in footings or offset joints a minimum distance of 5 feet.

d. When concreting is to be discontinued for more than 45 minutes, install keyways and embed dowels in the concrete before initial hardening.

1) Place dowels in joint one splice length into concrete section and one splice length into next concrete pour.

2) Use waterstops for structures below grade.

3) Horizontal joints are not permitted in slabs or footings.

e. No exceptions permitted to the above requirements unless written approval is given by the Engineer.

3. Expansion Joints and Contraction Joints in Walls:

a. Install where indicated on the Contract Drawings.

b. Do not extend reinforcing or other embedded metal items through joint except where indicated otherwise on Contract Drawings.

c. For joints exposed to liquids, in contact with earth, or exposed to weather, provide PVC waterstops in the joints.

4. Construction Joints in Elevated (Suspended) Formed Slabs:

Placement of additional joint locations shall meet the following:

a. Locate such joints to least impair the strength of the structure.

b. Space construction joints not greater than 30 feet in each direction, although some deviation from this spacing for column spacing and construction details, as approved by the Engineer, may be permitted. Reinforcement shall continue through construction joint.

c. Joints shall be located within the third point of slab span. Joints in girders should be offset a minimum distance of two times the width of any intersecting beam.

d. Beams, girders, or slabs supported by columns or walls shall not be cast or erected until concrete in the vertical support members is sufficiently hardened to support additional construction loads.
e. Where concreting is interrupted long enough for concrete to be hardened, install keyway and embed dowels in the concrete before initial hardening.

1) Place dowels in joint one splice length into slab and one splice length into next concrete pour.

2) Dowel to be spliced with top and bottom reinforcement; size of dowels to match slab reinforcement.

3) Do not “wet stab” dowels into fresh concrete or concrete that has not reached its final set.

f. Horizontal construction joints are not permitted in slabs; and are not allowed in beams, unless the joints in the beam are detailed in the structural contract drawings.

g. Provide PVC waterstop in joint where such joints are exposed to liquids, in contact with earth, or subject to weather exposure.

5. Control Joints in Slab-on-Grade:

a. Provide control joint spacing at the following maximum spacing unless noted otherwise:

1) 5 inch slab: 12 feet each way

2) 6 inch slab: 15 feet each way

3) 7 inch slab: 20 feet each way

4) 8 inch slab: 20 feet each way

b. Where contraction joint insert is used, press straight edge cutting tool into wet concrete to part aggregate. Place insert into separation until top of insert lays on surface of wet concrete. Remove top section of insert and float concrete to fill voids adjacent to the insert and finish concrete surface.

c. Sawcutting is permitted for control joints if denoted on Contract Drawings. Cut concrete as soon as it has hardened sufficiently; complete sawing within 12 hours after placement. Saw a continuous straight slot to a depth of one-quarter the thickness of the slab.
1) When saw cutting a new joint that crosses an existing saw cut joint, provide corner break-out protection for the existing joint.

2) Submit detailed procedure and plans for review and acceptance by the Engineer.

d. Fill all control joints with Control Joint Filler.

e. Where concreting is interrupted long enough for the placed concrete to harden, construction joint should be provided.

6. Construction Joints in Slabs on Metal Decking: Placement of additional joint locations shall meet the following:

a. Locate such joints to least impair the strength of the structure.

b. Space construction joints not greater than 30 feet.

c. For overpass bridge slab, joints shall be located near the one-third points of the span. Pour middle third slab section prior to placement of concrete in the outer-third sections.

d. No joint shall occur along length of beam top flange.

7. Bonding to New Concrete: Bond fresh concrete with hardened previously poured new concrete in accordance with the following:

a. Roughen and clean hardened concrete of foreign matter and laitance and dampen with water, but with no standing water.

b. Cover the hardened concrete with a heavy coating of grout to approximately ½ inch thickness. Use grout of same material composition and proportions of concrete being poured except coarse aggregate omitted. Use grout with a slump of 6 inches minimum.

c. Place new concrete on grout before it has attained its initial set.

d. Other bonding methods must be approved by Engineer prior to use.

8. Bonding to Existing Concrete: Roughen existing concrete in the area of bonding to produce exposed aggregate and an absolutely uncontaminated concrete surface.
a. Apply Epoxy Bonding Compound over existing prepared concrete in accordance with manufacturer's instructions.

B. Embedded Items: Pre-position waterstops, expansion joint materials, anchors, and other embedded items in advance of new concrete pours.

1. Embedded Pipes and Conduits: Material not harmful to concrete may be permitted to be embedded in concrete upon approval by the Engineer. Items embedded shall satisfy the following:
   a. Maximum outside dimension not greater than one-third the overall thickness of the member in which it is embedded.
   b. Minimum spacing between items not less than 3 widths on center nor 3 inches clear between items.
   c. Item shall not impair strength of member.
   d. Provide 2-inch minimum clearance to face of slab.
   e. Cutting, bending, or displacement of reinforcement will not be allowed.
   f. The item(s) to be embedded shall not cross expansion joints within the slab depth.
   g. The item(s) to be embedded shall not be made of aluminum.

2. Anchor Rod Placement:
   a. Install anchor rods accurately, vertically and horizontally, in the formwork as shown on the Contract Drawings.
   b. Insure rods are firmly held in the correct position and elevation by suitable templates during placement of concrete.
   c. The variation in location of anchor rods and other embedded items from the dimensions shown on the Contract Drawings shall meet the tolerances listed in AISC 303: “Code of Standard Practice for Steel Buildings and Bridges” (March 2010).

3. PVC Waterstops:
   a. Install in all joints where watertightness is required. Provide in joints exposed to liquids, in contact with earth, subject to weather exposure.
b. Use continuous lengths without splices where possible.

c. Provide factory-formed and tested waterstop corners and intersections leaving only straight butt joint splice in field.

d. Connect all adjoining waterstops including vertical and horizontal runs to provide continuous water barrier.

e. Splices:

1) Strength: Not less than 50% of the mechanical strength of the parent section.

2) Watertightness: Make equal to that of continuous material.

3) Heat seal adjacent surfaces in accordance with manufacturer’s recommendations using a thermostatically controlled electric source of heat that provides sufficient heat to melt but not to char the material.

f. Adequately support waterstops to prevent displacement and deformity of the waterstops during concrete pours. Maintain two-inch minimum clearance between waterstop and reinforcing steel.

g. Center waterstop on joint with one-half of waterstop width to be embedded in concrete on each side of joint. At expansion joints, keep center bulb unembedded in first concrete pour.

h. In substructures and other structures required to be watertight, install waterstops if concreting is discontinued for a sufficient length of time, which in the opinion of the Engineer, may result in seepage cracks in concrete.

4. Surface Applied Waterstop Installation: Install surface applied waterstop at such location defined on the Drawings.

a. Install the waterstop in strict accordance with the manufacturer’s installation instructions.

C. Anchoring Reinforcement Dowels into Concrete:

1. Drill holes for each dowel to the size and depth indicated on the Drawings with carbide tip bit or star bit. Core drilling will not be permitted. Do not drill into or cut or otherwise damage existing
reinforcement bars. If existing reinforcement bars are encountered during the drilling operation, relocate the hole to clear the existing reinforcement as directed by the Engineer.

2. Blow clean each finished hole with an oil free air jet and then flush with a jet of clean water.

3. Immediately prior to the grouting operation, remove all water from the hole and from the walls of the hole.

4. Pump dispensing gun for proper mixture. Insert nozzle and pump epoxy adhesive into the hole and insert reinforcement dowels. Mix and place the epoxy adhesive completely around the dowel bar in strict accordance with the manufacturer’s recommendations, with particular attention given to manufacturer’s specified time limit within which the material must be placed after mixing. Do not retemper grout that has begun to stiffen; discard such grout.

5. Plug unused holes as directed by the Engineer.

D. Installation of Vapor Barriers

1. General: Extend vapor barriers to extremities of areas to be protected from vapor transmission.

   a. Ensure base material, upon which vapor barrier is placed, is level and compacted.

   b. Installation shall be in accordance with manufacturer’s instructions and ASTM E1643.

   c. Coordinate vapor barrier placement with the installation of perimeter foundation insulation.

2. Installation of under slab vapor barriers:

   a. Install vapor barrier under slab on grade areas where specified on the contract drawings.

   b. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete pour.

   c. Lap vapor barrier over footings and seal to foundation walls.

   d. Overlap vapor barrier sides 6 inches and ends 12 inches; seal with manufacturer’s tape.
e. Seal all penetrations (including pipes) per manufacturer’s instructions.

f. No penetration of the vapor barrier shall be allowed except for reinforcing steel and permanent utilities.

g. Repair damaged areas immediately before concealment by other work by cutting patches of vapor barrier and overlapping damaged area 6 inches; tape all four sides.

3.03 CONSTRUCTION

A. Construction of Concrete Elements:

1. Construct the concrete elements indicated on the Contract Drawings or in the specifications; including but not limited to beams, columns, slabs, foundations, in-ground encasement of piping and conduit, reaction backings for piping, concrete backfill, and the reinforced concrete bases for equipment and piping provided under this contract.

2. Provide only Class A concrete in the project except for those cases where indicated otherwise on the Drawings or specified otherwise.

   a. Where in-ground encasement of piping is required, provide Class B concrete
      1) Encase pipes under structures and buildings or where indicated on the Contract Drawings; encase in concrete for the full length of the pipe run under the structure and as indicated.

   b. Where in-ground encasement of conduit runs is required, provide Class B concrete.
      1) Encase conduit runs indicated on the Contract Drawings.

   c. Provide Class B concrete for backfilling of overexcavated foundation area, foundation voids, and cavities.

B. Production of Concrete

1. Ready-Mixed Concrete:

   a. Batched, mixed, and transported in accordance with ASTM C94/C94M.
b. Add admixtures to the mix in accordance with ACI 301.

c. Plant equipment and facilities conforming to the "Check List for Certification of Ready Mixed Concrete Production Facilities" of the National Ready Mixed Concrete Association.

C. Placing

1. General: Conduct placement work in accordance with ACI 304R and such additional requirements as specified herein.

   a. Complete discharge of the concrete within 1 1/2 hours or before the mixing drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates.

2. Prepare:

   a. Prepare formwork:

      1) Remove snow, ice, water, and debris from within forms in advance of concrete pours in accordance with Section 03100.

   b. Pre-position reinforcement in advance of concrete pours in accordance with Section 03200.

   c. Pre-position waterstops, expansion joint materials, anchors and embedded items in advance of concrete pours.

   d. Sprinkle subgrades sufficiently to eliminate water loss from concrete in accordance with ACI 301.

      1) Subgrade shall be moist with no free water and no muddy or soft spots

   e. Do not place concrete on frozen surfaces.

   f. Place vapor barrier where indicated on Drawings.

3. Conveying:

   a. Handle concrete from mixer to final deposit rapidly by methods which will prevent segregation or loss of ingredients to maintain required quality of concrete.
b. Do not convey concrete through aluminum or aluminum alloy.

c. Do not place concrete by pumps or other similar devices without prior written approval of the Engineer.

d. Placing concrete by pumping methods shall conform to the applicable requirements of ACI 304R and ACI 304.2R.

4. Depositing:

a. Do not drop concrete freely where reinforcing will cause segregation, nor more than four (4) feet.

b. Deposit concrete in approximately horizontal layers of 12 to 18 inches.

c. Do not allow concrete to flow laterally more than three feet.

d. Place concrete at such a rate that concrete which is being integrated with fresh concrete is still plastic.

e. Do not deposit concrete on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within sections.

f. Do not use concrete which has partially hardened or has been contaminated by foreign materials.

g. Do not subject concrete to procedures which will cause segregation.

h. Do not place concrete in forms containing standing water.

i. Make placement within sections continuously to produce monolithic unit.

j. Do not bend reinforcement out of position when placing concrete.

k. Do not begin placement of concrete in elevated slabs and beams until concrete previously placed in walls or columns have attained initial set.

5. Consolidation:

a. Consolidate concrete by vibration, spading, rodding, or other manual methods. Work concrete around reinforcement, embedded items and into corners; eliminate all air or stone
pockets and other causes of honeycombing, pitting, or planes of weakness.

b. Use vibration equipment of internal type and not the type attached to forms and reinforcement.

c. Use vibrators capable of transmitting vibration to concrete in frequencies sufficient to provide satisfactory consolidation.

d. Do not leave vibrators in one spot long enough to cause segregation. Remove concrete segregated by vibrator operation.

e. Do not use vibrators to spread concrete.

f. Have sufficient reserve vibration equipment to guard against shutdown of work occasioned by failure of equipment in operation.

6. Cold Weather Concreting: Perform cold weather concrete work in accordance with ACI 306R and the following additional requirements.

a. Temperatures of the subbase and other surfaces that come in contact with concrete must be above freezing. The subbase and concrete forms surface must be free of snow and ice.

b. Do not place concrete around embedment, which has a temperature below freezing.

c. Provide equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. Do not use foreign materials or materials containing snow or ice.

   1) When using artificial heat, vent exhaust gases to the outside.

7. Hot Weather Concreting: Perform hot weather concrete work in accordance with ACI 305R and the following additional requirements.

a. Temperature of concrete delivered at the job-site shall not exceed 90 degrees F.

b. Cool ingredients before mixing to prevent temperature in excess of 90 degrees F.
c. Make provisions for windbreaks, shading, fog spraying, sprinkling or wet cover when necessary.

D. Finishing:

1. General: Finish concrete in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material.

2. Formed Surfaces: Provide one or more of the following finishes to the surfaces of the concrete after removal of forms. The locations where these finishes are required are listed herein or specified on the Drawings. Allowable surface irregularities are designed as either "abrupt" or "gradual.” Check gradual irregularities using 10-foot straightedges.

   a. "Rough Form" finish: Surface may include roughness and irregularities not to exceed ½ inch, but tie holes and defects shall be patched.

   b. "Ordinary Wall" finish: Surface that is true and uniform without any conspicuous offsets or bulges. Gradual irregularities not to exceed ½ inch and abrupt irregularities not to exceed ¼ inch.

   c. "Plywood" finish: Similar to the ordinary wall finish. Construct the surface of the forms using ⅝-inch plywood or boards lined with tempered hardboard not less than ³/₁₆ inch thick. Place the plywood or liner sheets in an orderly and symmetrical arrangement using sheets as large as practicable. Do not use sheets showing torn grain, worn edges, patches of holes from previous use, or other defects which will impair the texture of the concrete surfaces. Remove gradual irregularities exceeding ½ inch and abrupt irregularities exceeding ⅛ inch. Completely remove all fins on the surface. Rub all surfaces which cannot meet these requirements.

   d. "Rubbed" finish: Apply to a freshly hardened "plywood" finish. Complete rubbing within one day of removal of forms. Wet surfaces and rub with a carborundum brick or other abrasive until all form marks, projections, and irregularities have been removed and a smooth uniform surface, texture, and color are produced. Wash the surface clean after rubbing.

3. Unformed Surfaces:
a. General

1) In concrete having unformed surfaces, use just sufficient mortar to avoid the necessity for excessive floating.

2) Slope exposed unformed surfaces to provide quick, positive drainage and to avoid puddles in low spots.

3) Unless otherwise noted, set floor drains ½ inch below the normal floor elevation and slope floor toward the drain. Slope all surfaces exposed to weather ¼ inch per foot for drainage unless noted otherwise on Drawings.

b. Floor Flatness Measurement:

1) \( F_f \) (Flatness F-Number) defines relative smoothness of a floor slab; \( F_L \) (Levelness F-Number) defines relative conformity of floor surface to horizontal plane.

2) Floor tolerance measurements \( (F_f \text{ and } F_L) \) shall be tested in accordance with ASTM E1155.

3) Overall \( F_f \) and \( F_L \) Numbers represent test surface defined as total floor area of one building level.

4) Local \( F_f \) and \( F_L \) Numbers represent a test section within the concrete pour. Each test section shall not exceed 2,500 square feet.

5) Floor Overall F-Numbers shall conform to the following floor surface classifications defined in ACI 117:

   a) Mechanical and Electrical areas, slab surface under raised floors: Moderately Flat - \( \text{SOF}_f \text{ 25 / SOF}_L \text{ 20} \).

   b) Area not defined above: Flat - \( \text{SOF}_f \text{ 35 / SOF}_L \text{ 25} \).

6) Minimum Local F-Number tolerances shall be \( \frac{2}{3} \) of specified Overall F-Number tolerances.

7) \( F_L \) (Levelness F-Number) does not apply to unshored steel framed construction. The floor slab shall be constructed to meet the following tolerance:
a) Allowable variations from top of slab elevations identified on Contract Drawings: Plus/minus \( \frac{3}{8} \) inch.

8) Floor tolerance compliance tests shall be performed within 24 hours after placement and reported to Construction Manager within 72 hours.

c. "Floated" Finish: Place, consolidate, strike-off, and level concrete eliminating high spots and low spots; do not work further until ready for floating. Begin floating when water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.

d. "Steel Trowel" Finish: Obtained by working a floated finish with a steel trowel. First troweling shall produce a smooth surface which is relatively free of defects but which may still show some trowel marks. Perform additional trowelings by hand after the surface has hardened sufficiently. Perform final troweling when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate surface by hand trowel operations. Produce finished surface essentially free of trowel marks.

e. "Broom" Finish: Immediately after concrete has received a Floated finish, give surface a coarse transverse scored texture by drawing a broom or burlap across the surface.

4. Special Finishes:

a. Sand-Blasted Finish:

1) Coordinate formwork construction and removal to ensure surfaces to be finished are blasted at the same age for uniform results.

2) Provide a light sandblasting to remove the cement skin from the surface to achieve a smooth sand-textured surface

3) Abrasive blast corners and edges carefully to maintain uniform corner and edge line.

4) Use an abrasive grit of proper type and gradation to expose aggregate and surrounding matrix surface to duplicate the Control Sample mock-up.
5) Perform sandblast finishing in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish.

6) Protect adjacent material and finishes from dust, dirt, and physical damage.

5. Application for Finishes: Except where the type of finish is indicated on the drawings or under "Special Finish," all concrete surfaces shall be finished as indicated below.

a. "Rough Form" Finish:
   1) All surfaces to be covered by earth and not exposed to view.

b. "Ordinary Wall" Finish:
   1) Interior and exterior wall surfaces not exposed to view.
   2) Undersides of slabs which will be covered by Architectural ceiling.

c. "Plywood" Finish:
   1) All surfaces to be painted.

d. "Rubbed" Finish:
   1) All interior and exterior surfaces exposed to view which are not to be painted.
   2) All exterior surfaces to a point 6 inches below finished ground.
   3) Equipment pads, etc.

e. "Floated" Finish:
   1) All unformed surfaces unless otherwise specified.

f. "Steel Trowel" Finish:
   1) Interior floors of structures except where Architectural Finish is to be applied.
   2) Interior concrete stair treads.
3) Tops of exposed walls.

g. "Broom or Belt" Finish:
   1) Sidewalks, exterior ramps and platforms.
   2) Overpass bridge slab.

h. Non-slip Finish
   1) Exterior stair treads and landings.

i. Light Sand-Blasted Finish
   1) At locations denoted on the Drawings.

j. Architectural Finishes:
   1) Provide formed surface finishes to above grade elements exposed to view as specifically called for in the table below and these Specifications or on the Drawings.

<table>
<thead>
<tr>
<th>ARCHITECTURAL FINISHES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finish Type</td>
</tr>
<tr>
<td>Sand Blasted</td>
</tr>
<tr>
<td>4'0&quot; Modular Block</td>
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<tr>
<td></td>
</tr>
</tbody>
</table>

*Note: Applies to all above grade surfaces of noted elements where exposed to view

3.04 CURING AND PROTECTION

A. General: Immediately after placement and finishing, protect concrete from premature drying, excessive hot or cold temperatures and mechanical injury. Perform curing by water curing, sheet form curing, or liquid membrane forming methods in accordance with ACI 308. Cure concrete continuously for a minimum of seven days at ambient temperatures above 40 degrees F.

B. Hot Weather Curing: See Hot Weather Concreting this Specification.

C. Cold Weather Curing: See Cold Weather Concreting this Specification.

D. Application of Curing Compound: Compound shall restrict the loss of water to not more than .039 g/cm² of surface in 72 hours when tested in...
accordance with ASTM C156 at the coverage rate recommended by the manufacturer.

1. Submit letter from manufacturer stating coverage rate to meet this restriction in loss of water.

2. Finishing operations must be completed prior to application. Apply compound as soon as the free water on the surface disappears and no water sheen is visible. Surface shall be capable of taking walking workmen without being marred.
   a. Apply compound in two (2) applications. Apply the second coat perpendicular to the first coat.

3. Do not apply curing compound to construction joint surfaces. Protect exposed reinforcement during application of curing compound. Water cure those areas not coated with compound.
   a. Where an area has been accidentally coated with curing compound or another special coating, clean this excess coating from the surface by blast cleaning or using another method recommended by the manufacturer of the special coating.

4. Do not use liquid membrane-forming curing compound when the ambient air temperature during placement and for 24 hours after placement is or will fall below 35º F.

5. Do not use liquid membrane-forming curing compounds on concrete surfaces which will receive later treatments, such as hardeners, special finishes, protective coating, dampproofing, waterproofing, future grout, grout fill, or coatings.

E. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

F. High-Early strength concrete shall be maintained at 50º F and in a moist condition for at least the first three (3) days.

3.05 REPAIR/RESTORATION

A. The Engineer will determine the extent and manner of actions to be taken to repair defective concrete.

1. Obtain approval from the Engineer before performing repair work other than removing imperfect texture and filling pin holes and insert holes.
2. Prior to repairing defects, submit proposed materials and repair methods to the Engineer for approval.

B. Repair of Formed Concrete Surfaces:

1. As soon as the forms have been stripped from the concrete and the concrete surfaces have been exposed, do the following:
   
a. Remove fins and other projections, fill recesses left by the removal of form ties, and repair surface defects which do not impair the structural strength of the concrete.

   b. Clean all exposed concrete surfaces and adjoining areas stained by the leakage of concrete to the satisfaction of the Engineer.

2. Repair tie holes and other small cavities by cleaning out the resulting cavities, wetting the cavity area, and then filling the cavity with a stiff mortar of the same material used in the concrete, but somewhat leaner.

3. Repair and patch other defective areas with cement mortar of mix proportions and materials identical to those used in the surrounding concrete.
   
a. Produce a finish on the patch indistinguishable from the surrounding concrete.

4. Where honeycomb or voids are not excessive, and repairs are authorized by the Engineer, sawcut a ½- to ¾-inch deep square outline around the area of defective concrete, and chip out the defective concrete inside the outline to a depth not less than 2 inches until sound solid concrete is encountered.
   
a. If chipping is necessary, make edges of the depression perpendicular to the concrete surface or slightly undercut to provide a key at the edge of the patch.

   b. Thoroughly clean, dampen, and brush-coat the area to be patched with neat cement grout; and follow this preparation by placing a cement mortar to patch the concrete.

   1) Other patching materials may be used if accepted by the Engineer in writing prior to start of repair work.

   c. Keep the patch damp for 7 days at a temperature above 50º F.
C. Repair of Unformed Concrete Surfaces:

1. Finished flatwork exceeding the allowable tolerances may be repaired provided the strength or appearance of the flatwork is not adversely affected.
   a. Remove high spots with a terrazzo grinder.
   b. Fill in low spots with an approved patching compound.
   c. Perform other remedial measures as permitted by the Engineer.

2. Surface defects on unformed surfaces may be repaired provided the strength of appearance of the item is not adversely affected.
   a. Remove high spots and surface irregularities with a diamond-disk or stone grinder.
   b. Fill in low spots with an approved patching compound.

3.06 SITE QUALITY CONTROL

A. Site Tests and Inspections:

1. During the period when concrete is being placed, the Approved Agency must perform routine and other testing of materials.
   a. Advise the Approved Agency sufficiently in advance of operations to allow testing personnel to be assigned and to provide sufficient time for quality tests to be performed and completed.
   b. Provide and maintain adequate and separate facilities for safe storage and proper curing of concrete test cylinders on the Work Site for the sole use of the Approved Agency.
   c. Strength testing requirements are based on using 6-inch by 12-inch size cylinders.
   d. Provide containers for transporting concrete test cylinders to the testing laboratory.
   e. The Approved Agency will perform additional materials testing due to changed in materials or proportions requested by the Contractor or testing required due to failure of material to meet specified requirements.
f. Failure of the Approved Agency to detect defective work will not prevent its rejection later when the defect is discovered.

2. Concrete Slump Test:
   a. Test Procedure:
      1) Determine the slump of a concrete sample from each truckload of concrete upon its arrival at the Work Site.
      2) Determine the temperature of the concrete sample.
      3) Determine the slump according to the requirements of ASTM C143/ C143M.
   b. Acceptance Criteria:
      1) Refer to Subparagraph 2.02F.

3. Air Content Test:
   a. Test Procedure:
      1) Determine the air content of the concrete for each concrete strength test sample in accordance with ASTM C231, ASTM C173/C173M, or ASTM C138/ C138M.
   b. Acceptance Criteria:
      1) The Engineer will determine acceptability based on the results.

4. Concrete Strength Test for New Concrete:
   a. Test Procedure:
      1) Secure composite samples in accordance with ASTM C172.
         a) Obtain representative test samples from different batches of concrete on a truly random basis by selecting a test batch number at random before commencing the placement of concrete.
         b) When pumping or pneumatic equipment is used, obtain samples at the truck and discharge ends.
c) Take samples for each concrete mix design not less than once a day, or not less than once for each 100 cubic yards of concrete, or not less than once for each 3,000 square feet of surface area placed.

2) Mold at least 5 concrete test cylinders in strict compliance with the requirements of ASTM C31/C31M for each strength test, and cure the cylinders for a 24-hour initial curing period.

a) Have a responsible representative from the Approved Agency observe the making of the concrete test cylinders by the Contractor, and immediately thereafter pack them in a sturdy container furnished by the Contractor.

b) Surround the concrete test cylinders with wet sand or sawdust and protect them from freezing.

c) Sequentially number the concrete test cylinders and record the number, the date each cylinder was made, and the results of the slump test, air content, and the temperature for each sample on the proper form; forward the form to the Engineer, and then transport the cylinders to the testing laboratory where they will be cured in strict compliance with ASTM C31/C31M until the time of the test.

3) Each strength test will be conducted in accordance with ASTM C39/C39M as follows:

a) One 6-inch by 12-inch size concrete cylinder from the same sample will be tested 7 days after the cylinders were made for information.

b) An additional two 6-inch by 12-inch size concrete cylinders from the same sample will be tested for acceptance 28 days after the cylinders were made.

c) Two 6-inch by 12-inch size concrete cylinders will be put on hold for 56 days and tested only when the running average of three concrete cylinder tests falls below the acceptance criteria.
d) The result of the strength test is the average of the compressive strength results for the 2 specimen cylinders tested at 28 days.

e) If one concrete test cylinder in a strength test manifests evidence of improper sampling, molding, or testing, it will be discarded, and the strength of the remaining cylinder will be considered to be the test result; if both specimen cylinders in a test for a single sample show any of the above defects, the entire test for those samples will be discarded.

b. Acceptance Criteria:

1) The test results for standard molded and cured test cylinders will be evaluated separately for each specified concrete mix design by comparing the test results to the minimum requirements for the Class of concrete as specified in Subparagraph 2.02.

2) The strength level of the concrete will be considered satisfactory so long as the average of all sets of 3 consecutive compressive strength test results equal or exceed the specified strength \( f'c \), and no individual strength test result falls below the specified strength \( f'c \) by more than 500 psi.

5. Concrete Strength Test for Concrete in Place:

a. The Engineer will determine locations where the concrete in place is potentially deficient, and where to obtain test cores to least impair the structure’s strength.

1) As an aid to evaluate in place concrete strength or for selecting areas to be cored, the Engineer may permit concrete in place to be tested by impact hammer, sonoscope, or other non-destructive device to determine the relative strengths at various locations in the structure.

2) The preliminary non-destructive tests of concrete in place will not be used as a basis for accepting or rejecting the concrete; rather the core testing will be the basis for accepting or rejecting the in-place concrete.

b. Concrete Core Test:
1) Test Procedure:
   a) The Engineer will determine the locations in each member or area of concrete in place where the required cores may be obtained.
   b) At least 3 representative core samples will be taken from each member or area of concrete in place that is considered potentially deficient.
      (1) Each core sample will be at least 3 inches in diameter.
      (2) If the concrete in the structure will be dry under service conditions, the cores will be air dried for 7 days before the test at a temperature of 60º F to 80º F and a relative humidity of less than 60 percent; the cores will be tested dry.
      (3) If the concrete in the structure will be more than superficially wet under service conditions, the cores will be tested after moisture conditioning them in accordance with ASTM C42/ C42M.
   c) The core samples will be tested in accordance with ASTM C42/ C42M.
      (1) If one or more of the cores shows evidence of having been damaged before the testing, it must be replaced either subsequent to or during its removal from the structure.
   d) Solidly fill core holes with low slump concrete.

2) Acceptance Criteria:
   a) Concrete in the area represented by a core test will be considered adequate if the average compressive strength of the cores is equal to at least 85 percent of the specified strength f’c, and if no single core is less than 75 percent of the specified strength f’c.
   b) If the core tests fail to demonstrate concrete strengths adequate for the intended purpose of
the member or members in question, or are inconclusive or impractical to obtain, or if structural analysis does not confirm the safety of the structure, load tests may be required.

(1) The results will be evaluated in accordance with ACI 318/318R.

6. Inspections:

a. Concrete Surface Irregularities:

1) Evaluate floor flatness/levelness in accordance with criteria defined in ASTM E1155 and on the Contract Drawings.

B. Non-Conforming Work:

1. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in this Section.

a. The Engineer reserves the right to reject any or all items which do not meet the requirements of the Contract Drawings and Specifications.

b. Remove items determined to be non-conforming, and replace the non-conforming items removed with Work that conforms to the specified requirements.

2. Concrete Compressive Strength:

a. If concrete fails to meet the minimum specified compressive strength test requirements, the concrete represented by such tests will be considered questionable and subject to further testing and other requirements as follows:

1) Additional curing may be required as directed by the Engineer.

2) Modifications may be required for remaining concrete work, including changes in the concrete mix designs.

3) When the strength of the structure is considered potentially deficient, structural analysis and/or additional testing may be required.
a) If in the opinion of the Engineer there is cause for concern over the adequacy of the structure regardless of the results of any previous tests, additional tests of the hardened concrete may be required.

(1) The additional testing of questionable concrete will be conducted in accordance with the requirements of ASTM C42/C42M.

(2) If the initial test acceptance requirements had been met, the Contractor is not required to bear the costs of such additional tests unless their results confirm that the concrete in place is deficient.

3. Concrete Appearance:

a. Repair defects which adversely affect the appearance of the specified finish in concrete exposed to view if possible.

1) If in the opinion of the Engineer the defect cannot be repaired, the concrete may be accepted or rejected as provided in this Section.

2) Concrete not exposed to view is not subject to rejection for defective appearance.

4. Location of Members:

a. Concrete members cast in the wrong location may be rejected if the strength, appearance, or function of the structure is adversely affected; or if the misplaced items interfere with other construction.

5. Dimensional Tolerances:

a. Inaccurately formed concrete surfaces which are exposed to view and do not conform to the requirements of ACI 117/117R may be rejected.

1) Repair, or remove and replace, the section as required.

2) If the outlines of formed concrete surfaces are smaller than required by an amount exceeding the
requirements of ACI 117/117R, they will be considered deficient in strength.

3) If the outlines of formed concrete surfaces are larger than required by an amount exceeding the requirements of ACI 117/117R, they may be rejected.

a) The Engineer may require that the excess material be removed.

b) If the excess material is to be removed, do so in a manner that maintains the strength of the section and meets the other applicable requirements of function and appearance.

3.07 CLEANING

A. At the end of each day, clean and remove waste sandblasting material from the Work area.

B. After fiber-reinforced concrete has reached its 28-day design strength, burn off the exposed excess fibers.

3.08 ATTACHMENTS

A. The following attachments are appended to this Section following the "END OF SECTION" marker:

1. Final Concrete Mix Design Submittal Form.

2. Test Results Submittal Form.
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# Final Concrete Mix Design Submittal Form

(One for each required mix design)

**PROJECT:** ___________________  
**Location:** ___________________

**General Contractor:** 

---

**Mix design no.:** ________  
**Design strength:** ___________________

**USE (Describe):** ___________________

**Mix Design Preparation:** 
- Based on Standard Deviation Analysis: ____________________ 
- or Based on Trial Mixture Test Data: ____________________ 

**MATERIALS:** 

**Aggregates:** (Provide size, type, source, specification)

**Coarse:** 

---

**Fine:** 

---

**Cement Type/Source:** 

---

**Admixtures:** (Provide product, manufacturer)

- **Water Reducer:** __________________
- **Air Entraining:** __________________
- **Accelerator:** __________________
- **Other:** __________________

**CONCRETE PROPERTIES**

<table>
<thead>
<tr>
<th>Water/Cement Ratio:</th>
<th>______</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slump:</td>
<td>______</td>
<td>Abso</td>
</tr>
<tr>
<td>Entrained Air:</td>
<td>______</td>
<td>%</td>
</tr>
<tr>
<td>Density:</td>
<td>______</td>
<td>pcf</td>
</tr>
</tbody>
</table>

**SPECIFIC GRAVITIES**

- **Fine Aggregate:** ______
- **Coarse Aggregate:** ______

**ADMIXTURES**

- **Accelerator:** ______ oz. per 100# cement
- **W. R.:** ______ oz. per 100# cement
- **A. E.:** ______ oz. per 100# cement
- **Other:** ______ oz. per 100# cement

**TOTAL:** ______
TEST RESULTS SUBMITTAL FORM

METHOD 1 - STANDARD DEVIATION ANALYSIS (ACI 318-11 SECTION 5.3.2.1):
Number of Test Cylinders Evaluated: __________ Standard Deviation: __________
(Attach Copy of All Test Results)
Mix Designs Proportioned to Achieve Both of the Following:

\[ f'_{cr} = f'_c + 1.34s = \text{__________ psi} \]
\[ f'_{cr} = f'_c + 2.33s - 500 = \text{__________ psi} \]
Actual \( f'_c = \text{__________ psi} \) (\( \leq f'_{cr} \))
Slump = _______ Air Content = _______ %

METHOD 2 - TRIAL MIXTURE TEST DATA (ACI 318-11 SECTION 5.3.2.2):

<table>
<thead>
<tr>
<th>Age (days)</th>
<th>Mix 1 (comp. str.)</th>
<th>Mix 2 (comp. str.)</th>
<th>Mix 3 (comp. str.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>_______</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>28</td>
<td>_______</td>
<td>_______</td>
<td>_______</td>
</tr>
<tr>
<td>28</td>
<td>_______</td>
<td>_______</td>
<td>_______</td>
</tr>
</tbody>
</table>

28-day avg. _______ _______ _______

Mix Design Proportioned to Achieve the Following:

\[ f'_{cr} = f'_c + 1200 \text{ psi} \quad \text{(for } f'_c \leq 5000 \text{ psi)} \]
or
\[ f'_{cr} = f'_c + 1400 \text{ psi} \quad \text{(for } f'_c > 5000 \text{ psi)} \]
Slump = _______ in. Air Content = _______ %

REMARKS:

Note: Fill in all blank spaces. Use -0- (zero) or N/A (not applicable). See Design and Control of Concrete Mixtures, Portland Cement Association, for assistance in filling out this form.

SUBMITTED BY:
Ready-Mix Supplier: Name ____________________________________________
Address ____________________________________________________________
Phone Number______________________________________________________
SECTION 03400
PRECAST CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of furnishing and installing precast concrete components.

1.02 RELATED SECTIONS

A. Section 01300 - Submittals.
B. Section 03200 – Concrete Reinforcement.
C. Section 03300 – Cast-in-Place Concrete.
D. Section 05500 – Metal Fabrications.
E. Section 06602 – Flat Plastic Detectable Warning Tile

1.03 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials (AASHTO):
   1. Standard Specifications for Transportation Materials and Methods of Testing and Sampling:
      a. AASHTO M 251 - Standard Specification for Plain and Laminated Elastomeric Bridge Bearings.

B. American Concrete Institute (ACI):
   2. ACI 301 - Specifications for Structural Concrete.
   3. ACI 318/318R - Building Code Requirements for Structural Concrete and Commentary.

C. ASTM International (ASTM):
2. ASTM A82 – Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.


4. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

5. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.


12. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

13. ASTM C192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

14. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.


D. National Precast Concrete Association (NPCA):

1. NPCA Plant Certification Program.

2. NPCA Quality Control Manual for Precast Concrete Plants.

E. Precast/Prestressed Concrete Institute (PCI):

1. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products.

2. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.


1.04 SUBMITTALS

A. Product Data:

1. Precast concrete unit anchorage, lifting inserts, and other devices

2. Mechanical splice sleeves.


4. Accessory items.

B. Shop Drawings:

1. Precast concrete units, layout (installation) drawings, and reinforcement.

2. Manufacturer’s handling and installation methods for products.

C. Certificates:

1. Material certifications.

D. Design Submittals:

1. Concrete mix design proportions and concrete mix design test data.
E. Qualification Statements:

1. Precast concrete manufacturing plant’s quality control procedures or verification of the plant’s current NPCA Plant Certification.

F. Test Report

1. Slump test reports.
2. Compressive Strength test reports.
3. Air Content test reports.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Plant-Precast Structural Concrete Manufacturer’s Qualifications:
   a. Experience:
      1) Employ an experienced and acceptable precast concrete manufacturer to design and fabricate the precast concrete units.
      2) The precast concrete unit manufacturer must maintain a permanent quality control department, or retain an independent testing agency on a continuing basis.
         a) If an independent testing agency has been retained, the agency must issue a report, signed and sealed by a Professional Engineer licensed in the Commonwealth of Pennsylvania, detailing the ability of the precast concrete manufacturer to produce quality units consistent with industry standards.
      3) Submit documentation showing the precast structural concrete manufacturer has been regularly and continuously engaged in manufacturing structural precast concrete similar to those required under this Contract for at least 5 years.
   b. Plant Certification Requirements:
      1) The precast manufacturer must be certified by the NPCA Plant Certification Program and must meet the
requirements of PCI MNL-116 and/or PCI MNL-117 as applicable.

2) The precast manufacturer must have quality control procedures established in accordance with the NPCA Quality Control Manual for Precast Concrete Plants in place prior to and during production of the products for this Contract.

3) Submit the plant’s quality control procedures demonstrating adherence to the NPCA Quality Control Manual for Precast Concrete Plants, or verification of the plant’s current NPCA Plant Certification.

2. Professional Engineer Qualifications:
   a. Have the precast concrete manufacturer employ a licensed Professional Engineer, registered in the Commonwealth of Pennsylvania, who has experience performing precast structural concrete calculations to design the standard precast concrete units and prepare Shop Drawings.

B. Certifications:
   1. Material Certifications:
      a. Submit copies of material certifications and laboratory test reports from the precast concrete manufacturer for the Portland Cement, aggregates, admixtures, and curing compound proposed for the Work of this Section.
      b. For reinforcement steel material, submit certified copies of mill test.

C. Mock-Ups:
   1. Because color variations and surface imperfections are not always apparent on small scale samples, a full-size mock-up of the concrete finishes are required for approval prior to starting production.
      a. The approved mock-up shall be used as the standard for the aesthetic quality of the surface finish; it shall be the Control Sample.

   2. The Project Manager will visit the precast manufacturer to inspect the plant and the mock-up sample.
1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:

1. Ensure adequate access to the Site is available to enable hauling, storage, and proper handling of the precast concrete units.

2. Do not ship precast concrete units that do not meet the specified criteria.

3. Transport precast concrete units in a manner that minimizes potential damage.

4. Each precast concrete will be examined unit as it is delivered to the Site for quality and acceptance; unacceptable units will be rejected.

B. Storage and Handling Requirements:

1. Employ lifting methods and devices intended for the purpose as indicated on the approved Shop Drawings.

   a. Submit manufacturer’s information showing acceptable handling methods for the products.

   b. Lift precast concrete units at points provided by the precast concrete manufacturer using suitable lifting devices.

   c. Consistent with industry standards, furnish lifting devices having a minimum factor of safety of 4.

      1) Furnish reusable lifting hardware and rigging having a minimum factor of safety of 5.

2. Store and handle precast concrete units in a manner that will minimize potential damage.

   a. Do not place units directly on the ground.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. Concrete Compressive Strength:

1. Provide precast concrete units having a 28-day compressive strength (f’c) indicated in the Contract Documents.

B. Precast Concrete Units:
1. Have the Professional Engineer employed by the precast concrete manufacturer perform the following tasks:

   a. Verify the precast concrete units can withstand the stresses induced during shipping, handling, and installation in order to avoid product cracking or other handling damage.

   b. Develop the complete analysis for lifting stresses, the sizing of lifting devices, and foundation attachment.

   c. Determine the concrete mix design proportions.

      1) Submit a mix design for each strength and type of concrete to be used.

         a) Include copies of concrete mix design test reports complying with the requirements of Section 4 in ACI 301 showing the mix has successfully produced concrete with the specified properties, and will be suitable for Contract conditions.

         b) Provide the quantity, type, and brand of all mix design constituents in the design, and include applicable data sheets for each constituent.

   d. Prior to fabricating the precast concrete units, prepare Shop Drawings for the precast concrete units showing complete design, installation, and construction information.

      1) Include details showing the size and placement of steel reinforcement.

      2) Indicate the type and configuration of joints and sealants between adjacent units.

      3) Include plans and elevations showing dimensions, connection details, finishes, openings, cast-in-place items, and the erection sequence.

2. Submit the precast concrete unit Shop Drawings and design calculations, prepared, stamped, and signed by the Professional Engineer.

3. Precast concrete units shall utilize epoxy coated reinforcing steel.
2.02 MATERIALS

A. Cement:
   1. Type I or II cement complying with the requirements of ASTM C150.
   2. For all exposed precast concrete use the same brand, type, and source of cement.

B. Normal Weight Concrete Coarse and Fine Aggregates:
   1. Aggregates complying with the requirements of ASTM C33.
   2. Do not provide aggregates that contain substances which may be deleteriously reactive with the alkalis in the cement.

C. Admixtures:
   1. See Specification Section 03300 for admixture types and usage

D. Water:
   1. Potable water or water clean and free of injurious amounts of oils, acids, alkalis, salts, and other substances deleterious to concrete and concrete reinforcement.


F. Concrete Reinforcement:
   1. Reinforcement Bars:
      a. Deformed Billet-Steel:
         1) Deformed billet-steel reinforcing bars complying with the requirements for Grade 60 bars as specified in ASTM A615. Reinforcing shall be epoxy coated. (Refer to Section 03200 for coating material.)
   2. Wire:
      a. Plain wire complying with the requirements of ASTM A82.

G. Inserts and Embedded Metal:
   1. Provide inserts and embedded metal items of the type required for the intended use that comply with the following:
a. Provide structural steel plates, angles, and other shapes complying with the requirements of ASTM A36.

b. Hot-dip galvanize items in accordance with the requirements of ASTM A123.

c. Provide proprietary items in accordance with the manufacturer’s published literature.

H. Structural Steel Plates and Shapes:
   1. Plates and shapes conforming to requirements of ASTM A36.
   2. Hot-dip galvanized items in conformance with ASTM A123.

I. Anchorage, Lifting Inserts, and Devices:
   1. For the precast concrete unit anchorage, lifting inserts, and other devices, submit Product Data sheets and proper installation instructions from the precast concrete manufacturer for approval.
      a. Clearly indicate precast concrete unit dimensions.
      b. Clearly indicate safe working loads.

J. Bearing Pads:
   1. Provide a multi-polymer plastic shim pad impervious to liquids, alkalis, and microorganisms that provides load-bearing surface contact.
      a. Compressive Strength: 8000 psi minimum with no fracture at 26,000 psi.
      b. Coefficient of linear expansion: 3 to 5 x 10^{-5} inches/inch/ºC.
   2. Manufacturers:
      a. Dayton Superior.
      b. JVI.


2.03 FABRICATION

A. Shop Fabrication:
1. The precast concrete producer must conform to the requirements of the NPCA Quality Control Manual for Precast Concrete Plants.

2. Concrete Forms:
   a. Provide forms for manufacturing precast concrete units of the type and design consistent with industry standards and practices.
      1) Provide forms capable of consistently providing uniform products and dimensions.
      2) Construct the forms so the forces and vibrations to which the forms will be subjected cause no damage to the precast concrete unit.
   b. Clean concrete build-up from the forms after each use.
   c. Apply release agents to the forms according to the manufacturer’s recommendations, but do not allow release agent to build-up on the form’s casting surfaces.

3. Concrete Reinforcement:
   a. For placing and splicing, conform to ACI 318/318R.
   b. Provide concrete cover on the reinforcement as shown on the Contract Drawings.
   c. Fabricate cages of reinforcement by tying the bars into rigid assemblies.
   d. Position the reinforcing as specified by the design so the concrete cover conforms to the requirements.
   e. Provide positive means to assure the reinforcement does not move significantly during the casting process.
   f. Do not use metal chairs along exposed face of member

4. Embedded Items:
   a. Position embedded items at the locations indicated in the Contract Documents and approved Shop Drawings.
   b. Hold inserts, plates, lifting devices, and other items to be embedded in the precast concrete rigidly in place so they do not move during casting operations.
5. Concrete:
   a. Mixing Concrete:
      1) Perform mixing operations so the concrete produced is uniform in strength, consistency, and appearance.
   b. Placing Concrete:
      1) Deposit conventional concrete in the forms as near to the final location as practical.
      2) Consolidate concrete so segregation of the concrete and the creation of honeycombed areas are minimized.
         a) Furnish vibrators for consolidating the concrete having frequencies and amplitudes sufficient to produce well-consolidated concrete.
   c. Curing Concrete:
      1) Commence curing operations immediately following the initial set of the concrete and of surface finishing.
      2) Using one of the following methods, prevent moisture from evaporating from exposed surfaces until adequate strength for stripping the precast concrete unit from the forms is reached:
         a) Cover the concrete with polyethylene sheets using sheets as specified in ASTM C171, or
         b) Cover the concrete with burlap or another absorptive material and keep the material moist, or
         c) Apply a membrane-curing compound as specified in ASTM C309 at a rate not exceeding 200 square feet per gallon, or in accordance with the manufacturer’s recommendations.
 6. Stripping Precast Concrete Units from Forms:
   a. Do not remove precast concrete units from the forms until the concrete reaches the compressive strength required by the design for stripping.
b. If no such requirement exists, products may be removed from the forms after the final set of concrete provided stripping does not have an effect on performance or appearance of the final product.

1) Routinely measure the stripping strengths to ensure the product has attained sufficient strength for safe handling.

B. Fabrication Tolerances:

1. Provide precast concrete units conforming to the unit tolerances specified in PCI MNL-117.

2.04 MIXES

A. Concrete Mix Design:

1. Concrete Proportions:

a. Base the selection of concrete proportions on the methodology presented in ACI 211.1 for normal weight concrete.

b. Develop concrete proportions using the same type and brand of cement, the same type and gradation of aggregates, and the same type and brand of admixture.

c. Do not use accelerators containing calcium chloride in precast concrete containing reinforcing steel or other embedded metal items.

2. Water-Cement Ratio:

a. Provide concrete mixes having a water-cement ratio of 0.45 or less.

3. Air Content:

a. Provide concrete mixes having a total air content of 6 percent plus or minus 1 percent by volume.

2.05 FINISHES

A. Shop Finishing Methods:

1. If no finishing procedure is specified, finish concrete surfaces using a strike-off at the level of the top of the form; otherwise finish unformed surfaces of precast concrete products as specified:
a. Formed Non-Architectural Surfaces:
   1) Cast surfaces against approved forms in accordance with standard industry practices for cleaning forms, designing concrete mixes, placing concrete, and curing concrete.
   2) Normal color variations, form joint marks, small surface holes caused by air bubbles, and minor chips and spalls will be accepted.
   3) Major imperfections, excessive honeycombing, and other major defects are unacceptable.
   4) Provide a “rubbed” finish to vertical surfaces of precast beams, piers, and platforms exposed to view. See Specification 03300 for surface finish requirements.

b. Unformed Surfaces:
   1) Finish unformed surfaces with a vibrating screed, or by hand with a float.
   2) Normal color variations, minor indentations, and minor chips and spalls will be accepted.
   3) Major imperfections, excessive honeycombing, and other major defects are unacceptable.
   4) Provide a “broom finish” to top surface of the precast platform and stair elements. See Section 03300 for surface finish requirements.

c. Light Sand-Blasted Finish
   1) Provide a light sand blasting to remove the skin from the concrete surface to achieve a sand-textured surface.
   2) Perform the finishing in accordance with industry standards or supplier specifications.
   3) Use an abrasive grit of proper type and gradation to duplicate the Control Sample mock-up.

d. Formed Architectural Surfaces
1) Provide formed surface finishes to above grade elements exposed to view as specifically called for in the table below and these Specifications or on the Drawings.

**ARCHITECTURAL FINISHES**

<table>
<thead>
<tr>
<th>Finish Type</th>
<th>Element</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand Blasted</td>
<td>Precast Infill Panels, Ramp Side Walls</td>
</tr>
<tr>
<td>4'-0&quot; Modular Block</td>
<td>Stair/Elevator Tower Foundation Walls, Station Building Foundation Walls, Precast Pier Caps</td>
</tr>
</tbody>
</table>

*Note: Applies to all above grade surfaces of noted elements where exposed to view

**2.06 SOURCE QUALITY CONTROL**

A. Tests and Inspections:

1. During the period when precast concrete is being placed, the Testing and Inspection Agency must perform routine and other testing of materials.
   
   a. Advise the Testing and Inspection Agency sufficiently in advance of operations to allow testing and inspection personnel to be assigned and to provide sufficient time for quality tests to be performed and completed.
   
   b. Provide and maintain adequate and separate facilities for safe storage and proper curing of concrete test cylinders.
   
   c. Provide containers for transporting concrete test cylinders to the testing laboratory.

2. Tests:

   a. The precast concrete manufacturer must demonstrate the following quality control tests are performed as required in accordance with the specified ASTM International standards by submitting test reports documenting compliance with the following tests:

   b. Slump Test:

      1) Test Procedure:
a) Perform a slump test in accordance with the requirements of ASTM C143 either for each 50 cubic yards of concrete produced for each mix design, or once a day, whichever comes first.

2) Acceptance Criteria:
   a) Slump of up to 4 inches is acceptable unless a high range reducing admixture is used, in which case slump up to 8 inches is acceptable.

c. Compressive Strength Test:
   1) Test Procedure:
      a) For each mix design, perform a compressive strength test on at least 4 specimens for each 50 cubic yards of concrete produced for each mix design.
         (1) Test 2 cylinders at 7 days and 2 cylinders at 28 days.
      b) Perform a compressive strength test in accordance with the requirements of ASTM C39.

2) Acceptance Criteria:
   a) Mixes having the 28-day compressive strength (f'c) as specified in Subparagraph 2.01.A are acceptable.

d. Air Content Test:
   1) Test Procedure:
      a) Perform an air content test in accordance with the requirements of either ASTM C231 or ASTM C173 for each 50 cubic yards of concrete produced for each mix design, but not less than once a day.

2) Acceptance Criteria:
   a) Concrete having the air content as specified in Subparagraph 2.04.A are acceptable.
3. Inspections:
   a. An inspector may be placed in the precast concrete unit manufacturing plant when the units provided under this Section are being manufactured.

B. Non-Conforming Work:

   1. Repairing Minor Defects:
      a. Products having defects that will not impair the functional use or expected life of a precast concrete unit may be repaired by an approved method that does not impair the product.
         1) Formed surfaces relatively free of air voids and honeycombed areas do not require patching and repair unless the surfaces are required to be finished by the design or are exposed to public view.
         2) Submit the materials and methods proposed for repairing surface defects for approval.

   2. Repairing Honeycombed Areas:
      a. Where honeycombed areas are to be repaired, remove all loose material and cut back the areas to essentially horizontal or vertical planes.
         1) Cut back the areas to a depth where coarse aggregate particles break under chipping rather than being dislodged.
      b. Use proprietary repair materials in accordance with the manufacturer’s instructions to fill the depression.
      c. If proprietary repair materials are not used, saturate the area with water immediately prior to starting the repair.
         1) Make sure the repair area is damp, but free of excessive water.
         2) Apply a cement-sand grout or an approved bonding agent to the chipped surfaces, followed immediately by consolidating an appropriate repair material into the cavity.

   3. Repairing Major Defects:
a. Have qualified personnel evaluate defects in precast concrete products which impair the functional use or the expected life of the products to determine if repairs are feasible, and if so, to establish the repair procedure.

4. Finish Requirements:
   a. Repair and patching work must comply with finish requirements of the Contract for the item.
      1) Colors of repaired and patched work must reasonably match the colors specified for the work and/or surrounding areas.

C. Coordination of Other Tests and Inspections:
   1. Notify the Testing and Inspection Agency responsible for performing special inspections when concrete for this Contract is being mixed, placed, and/or tested.
   2. Cooperate with the Testing and Inspection Agency when they are performing required material verifications and other special inspections.
      a. Provide full access to the Work.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions:
   1. Verify the structure and anchorage inserts for the precast members to be placed are within the allowable tolerances.

B. Evaluation and Assessment:
   1. Notify the Project Manager of out of tolerance anchorage inserts for the precast members.

3.02 PREPARATION

A. Protection of In-Place Conditions:
   1. Erect adequate barricades, warning lights, and/or signs to safeguard traffic in the immediate area of hoisting and handing operations.
3.03 ERECTION

A. Erect precast concrete units to the lines and grades indicated in the Contract Documents or as otherwise specified.

B. Fasten the precast concrete units in place in accordance with the approved Shop Drawings.
   1. Submit the precast concrete unit manufacturer’s installation instructions for information.

C. Furnish and maintain temporary bracing in place for the precast concrete units until final support and bracing is provided to maintain position, stability, and alignment.

D. Special Techniques:
   1. Field modifications to the precast concrete units are not allowed unless approved by the precast unit manufacturer and the Project Manager.

E. Tolerances:
   1. Furnish, erect, and interface precast concrete members within the tolerances specified for the applicable element type in PCI MNL-135.

3.04 REPAIR/RESTORATION

A. The repair of damage occurring to the precast concrete units after installation is the responsibility of the Contractor.
   1. Repairs made to exposed surfaces must match the color and texture of the surrounding concrete.

3.05 SITE QUALITY CONTROL

A. Site Tests and Inspections:
   1. During the period when precast concrete is being erected, the Testing and Inspection Agency must perform testing and inspections.
      a. Advise the Testing and Inspection Agency sufficiently in advance of operations to allow testing and inspection personnel to be assigned and to provide sufficient time for quality tests to be performed and completed.
b. Cooperate with the Testing and Inspection Agency to facilitate their testing and inspections.

c. Failure of the Testing and Inspection Agency to detect defective work will not prevent its rejection later when the defect is discovered.

2. Inspections:

   a. Observe the lines and grades of installed units to verify they are correct.

B. Non-Conforming Work:

1. Notify the precast concrete erector of observed discrepancies between the lines and grades of installed units and those indicated in the Contract Documents so corrective action can be taken.

3.06 CLEANING

   A. Clean soiled precast concrete surfaces, taking care to prevent damage to the surfaces and surrounding materials.

3.07 PROTECTION

   A. Immediately after the precast concrete units are erected, protect the units from damage.

END OF SECTION
SECTION 03600
GROUT

PART 1  GENERAL

1.01  DESCRIPTION
A. This section covers the furnishing and placing of grout as specified on the drawings and in various other sections of these specifications.

1.02  RELATED SECTIONS
A. Section 01300: Submittals.
B. Section 01400: Quality Requirements.
C. Section 03300: Cast-in-Place Concrete.

1.03  REFERENCES
A. American Association of State Highway and Transportation Officials (AASHTO):

B. American Concrete Institute (ACI):
   4. ACI 308: Standard Practice for Curing Concrete.
   5. ACI 351.1R: Grouting between Foundations and Bases for Support of Equipment and Machinery.

C. ASTM International (ASTM):


1.04 SUBMITTALS

A. Product Data: Submit manufacturer’s descriptive product data and current specifications covering named manufactured products specified in this Section. Include placing instructions. Submit product data for the following:

1. Non-Shrink Non-Metallic Grout.

B. Certificates:

1. Grout manufacturer non-shrink certification.


1. Contractor shall coordinate with the requirements of the special inspections program as identified in Section 01410.

2. The Agency shall be submitted for approval prior to proceeding with the work. The Agency shall have recent experience acceptable to the SEPTA Project Manager in the testing and inspection of similar projects. The SEPTA Project Manager reserves the right to reject any Agency deemed to be insufficiently qualified.

1.05 QUALITY ASSURANCE

A. Non-Shrink Grout Performance Qualifications: Furnish the grout manufacturer's current independent laboratory test results indicating the grout conforms to the following:

1. Early height change of 0.0% to 4.0%, according to ASTM C827.

2. Hardened height change of 0.0% to 0.3% according to ASTM C1090.

3. Compressive strength of 4,000 psi strength developed with a trowelable mix within 24 hours when tested in accordance with the
requirements of ASTM C109 modified in accordance with the requirements of ASTM C1107.

4. Placement time based on initial set of not less than 60 minutes at 70\(^\circ\) F.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide protective covering over materials to prevent moisture damage and contamination of grout materials.

B. Store and pre-condition grout and grout materials in accordance with the grout manufacturer’s requirements. Provide air-conditioned storage if required.

C. Store grout materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.07 PROJECT CONDITIONS

A. Environmental Requirements: Protect against high and low temperatures and unfavorable environmental conditions in accordance with American Concrete Institute standards for placement of concrete (ACI 305R, 306R, and 306.1).

PART 2 PRODUCTS

2.01 MATERIALS

A. Water: Potable quality; free from deleterious amounts of acids, alkalis, and organic substances.

B. Non-Shrink Non-Metallic Grout:

1. A factory-premixed material containing no corrosive irons, aluminums, chemicals, or gypsums meeting ASTM C1107 Grades A, B, and C.

   a. Provide a ready-mix type of grout requiring only the addition of water.

   b. Do not add other materials to the grout.

2. Acceptable manufacturers for non-shrink non-metallic grout include the following:

   a. Five Star Products, Inc.

   b. Euclid Chemical Company.
c. Or approved equal.

C. Portland Cement:

1. Portland Cement conforming to the requirements of ASTM C150 Type I.

2.02 MIXES

A. Neat Cement:

1. Use Type I Portland Cement and water in the same proportions specified in Section 03300 for Class A cast-in-place concrete, but omit the fine and coarse aggregates from the mix.

PART 3 EXECUTION

3.01 PREPARATION

A. Preparation of Surface: Clean surfaces to be grouted to be free of oil, grease, laitance, dirt and other contaminants. Remove loose material. Remove rust, paint, and oil from metal components in contact with grout.

1. Additional Preparation: Perform additional surface preparation in accordance with manufacturer’s instructions.

B. Formwork: Use forming procedures that allow proper and complete placement of grout.

1. Pre-treat wood forms with forming oils so they do not absorb moisture.

2. Anchor Support elements of formwork so no movement is possible. Remove supports only after grout has hardened.

C. Grout Mixing: Use power operated mechanical mixer of sufficient capacity to carry out batch mixing without interruption.

1. Mix Non-Shrink Non-Metallic Grout in accordance with manufacturer’s instructions.

3.02 INSTALLATION

A. Provide support for equipment and machinery by placing grout between the foundations of supporting structures and the equipment and machinery bases in accordance with the requirements of ACI 351.1R.

1. Non-Shrink Non-Metallic Grout:
a. Place non-shrink non-metallic grout in exposed and unexposed areas at locations indicated on the Contract Drawings.

b. Mix, place, and cure non-shrink non-metallic grout in accordance with the manufacturer’s published instructions.

3.03 SITE QUALITY CONTROL

A. Site Tests and Inspections:

1. During the period when grout is being placed, the Independent Testing and Inspection Agency (Agency) must perform routine and other testing of materials. The Agency shall submit reports directly to the SEPTA Project Manager.

a. Advise the Agency sufficiently in advance of operations to allow testing personnel to be assigned and to provide sufficient time for quality tests to be performed and completed.

b. Provide and maintain adequate and separate facilities for safe storage and proper curing of grout test samples on the Work Site for the sole use of the Agency.

c. Provide containers for transporting grout test samples to the testing laboratory.

d. The Agency will perform additional materials testing due to changes in materials or proportions requested by the Contractor or testing required due to failure of material to meet specified requirements.

e. Failure of the Agency to detect defective work will not prevent its rejection later when the defect is discovered; neither does it obligate the SEPTA Project Manager to grant final acceptance of the Work.

2. Compressive Strength Test:

a. Test Procedure:

(1) A test sample will be obtained from the first placement of the day and for every 3 cubic yards of grout placed each day.
(2) The grout will be tested in accordance with the requirements of ASTM C109 modified in accordance with the requirements of ASTM C1107.

b. Acceptance Criteria:

(1) Grout meeting the requirements specified in Subparagraph 1.05 will be acceptable.

3. Inspections:

a. All grout placement will be visually inspected to verify if proper placement procedures are being followed.

B. Non-Conforming Work

1. Remove under-strength grout, and replace the removed grout with grout meeting the specified requirements.

END OF SECTION
SECTION 04210

CLAY MASONRY UNITS

PART 1    GENERAL

1.01 DESCRIPTION

A. The work of this section shall include but not be limited to supplying and installing the following Masonry Veneer System:

1. Brick Masonry Units
2. Mortar for Unit Masonry
3. Reinforcement, Anchorages, Flashing, and Accessories

1.02 RELATED SECTIONS

A. Section 01300 – Submittals.
B. Section 01401 – Quality Requirements.
C. Section 01700 – Contract Closeout.
D. Section 13121 – Pre-Fabricated Station Building.

1.03 REFERENCES

N. CSA A370-94: Connectors for Masonry.

1.04 QUALITY CONTROL

A. Maintain (1) copy of manufacturer’s installation instructions on project site.
B. Verify that manufacturer’s label contains reference to specified standards.
C. Manufacturer’s Qualification: The manufacturer shall have experience in the successful completion of projects employing similar materials, applications, and performance requirements.
   1. The manufacturer shall provide a list of five (5) similar completed projects with addresses of the project location, architect, and owner.
D. Obtain all masonry units of uniform texture and color, or a uniform blend within ranges accepted from a single manufacturer.
E. All layout and designs shall conform to current building codes (IBC).
F. Mock-Up
1. Construct typical mock-up panel 48” x 48” to illustrate masonry units, coursing, mortar joints, movement control joints, anchorage, color, pattern, and finish.

2. Installation of clay masonry units cannot continue until the mock has been reviewed and approved by SEPTA

1.05 SUBMITTALS

A. Submit under provisions of Section 01300 – Submittals.

B. Manufacturer’s Installation Instructions: Provide published instructions that indicate preparation and installation procedures.

C. Product Data: Submit manufacturer’s product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total system.

D. Samples: Submit (1) sample of each calcium silicate masonry unit for each application to illustrate color and texture.

E. Shop Drawings: Submit small-scale (1/8”=1'-0" minimum) layouts of units and joints, and large-scale (1 1/2"=1'-0" minimum) details of edge conditions, joints, corners, custom profiles, supports, anchorages, flashings, and special details.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver mortar materials in original unbroken and undamaged packages with the maker’s name and brand distinctly marked thereon, and upon delivery store off of ground and covered with a waterproof, breathable covering, slope top to drain water. Allow free movement of air circulation to prevent condensation build up.

B. Store or pile sand on a plank platform and protect from dirt and rubbish. Store mortar materials and sand in such a manner as to prevent deterioration or contamination by foreign materials.

C. Deliver masonry units to the site in approved protective film. Prevent damage to units.

D. Lift skids with proper and sufficiently long slings or forks with protection to prevent damage to units. Protect edges and corners.

E. Store masonry units in a manner designed to prevent damage and staining of units.
F. Stack units on timbers or platforms at least 3" above grade.

G. Place polyethylene or other plastic film between wood and other finished surfaces of units when stored for extended periods of time.

H. Cover stored units with protective enclosure if exposed to weather.

I. Do not use salt or calcium-chloride to remove ice from masonry surfaces.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. In order to establish a standard of quality, subject to compliance with requirements, provide the following, or approved equal.

1. Brick Veneer: Redland Brick, Inc./15718 Clear Spring Road/ P.O. Box 160/Williamsport, MD 21795; (301) 223-7700.
   a. Local Representative: Church Brick Company/118 Burlington Rd./Bordentown, NJ 08505; (609) 298-0090.

2. Reinforcement: Dur-O-Wal, Inc. or approved equal.

3. Accessories: Hohmann & Barnard, Inc. or approved equal.

2.02 BRICK UNITS

A. Brick units shall conform to ASTM C-216, Grade SW, Type FBS and the following:


2. Coursing Style: See drawing elevations.

3. Size: 2 1/4" x 7 5/8" x 3 5/8"

4. Minimum Compressive Strength: 12,000 psi

5. Test results showing no efflorescence.

6. Color: King William

2.03 MORTAR MATERIALS

A. Portland Cement to CAN/CSA-A5, Type 10; Color selected by Architect from the full range of manufacturer’s colors.
B. Hydrated Lime to ASTM C 207, Type S
C. Mortar Aggregate to CSA A179, Standard Masonry Type; Keep clean, dry protected against dampness, freezing and foreign matter.
D. Water: potable, clean and free of deleterious amounts of acids, alkalis, or organic materials.

2.04 MORTAR MIXES
A. Mortar for Calcium Silicate Masonry Units to ASTM C207. Proportion specification, (1) part Portland Cement, (1) part Hydrated Lime, (6) parts mortar aggregate by volume for both cementitious materials and aggregate.

2.05 MORTAR MIXING
A. Thoroughly mix mortar ingredients in proper quantities needed for immediate use to requirements of ASTM C 270.
B. Add mortar color and admixtures to requirements of manufacturer's instructions.
C. Provide uniformity of mix and coloration.
D. Take representative samples for testing consistency of strength and color according to ASTM C 780.
E. Use mortar within 2 hours after mixing at temperatures of 84°F, or 2-1/2 hours at temperatures under 52°F.

2.06 REINFORCEMENT AND ANCHORAGES
A. Bed Joint Reinforcement: Single-wire type; 0.186"; stainless steel, conforming to ASTM A 580.
B. Galvanized Steel Lintel Angle Anchors for Window and Door Surrounds. Provide Engineering Calculations for appropriate sizing.
C. Wall Ties: H-B Veneer Anchors: X-Seal Byna-Lok Anchor System or approved equal with Adjustable Stainless Steel Ties.

2.07 MISCELLANEOUS
A. Flashing
   1. Provide Stainless Steel Flashing 26 Ga. Type 304.
2. Install through-wall flashing over exterior windows, relieving angles, doors, tops of walls, at the inside base of cavity walls, and under sills. Extend ends of sill flashing beyond jamb line and turn up into wall to create an end dam to divert moisture toward the wall face. Extend flashing over veneer, turn up minimum 8” and bed into mortar joint of masonry, or seal to sheathing.

B. Weep Holes

1. Pre-formed plastic insect resistant vents with sloping louvers.

2. Install weep holes in veneer masonry at maximum 24” on center horizontally above through-wall flashing, above shelf angles, lintels, bottom of walls and elsewhere as indicated on drawings.

C. Anti-Graffiti coating

1. Prosoco, Blok-Guard & Graffiti Control II, or approved equal

2.08 FABRICATION TOLERANCES

A. Fabricate masonry units to the following tolerances:

1. Unit Length: ± 1/16”.

2. Unit Height: ±1/16”.

3. Deviation from Square: ±1/16”, with measurement taken using the longest edge as the base.

4. Bed Depth: ±1/8”.

5. Custom Dimensions: ±1/8”.

6. Unit Face Deviations: ±3/8”.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing site conditions under provisions of Section 01700 Contract Closeout.

3.02 PREPARATION

A. Supply metal anchors for placement. Direct correct placement
B. Verify items provided by other sections of work are properly sized and located.

3.03 ENVIRONMENTAL REQUIREMENTS
A. Maintain materials and surrounding air temperature to minimum 52°F prior to and 48 hours after completion of masonry work.
B. Cold Weather Requirements: CSA A371

3.04 CUTTING OF MASONRY UNITS
A. Cut masonry units with wet-saw.
B. Pre-Soak units using clean water prior to cutting.
C. Clean cut units using a stiff fiber brush and clean water. Allow units to surface dry prior to placement.

3.05 COURSING
A. Place masonry to lines and levels indicated.
B. Maintain masonry courses to uniform width. Make vertical and horizontal joints equal and of uniform thickness.
C. Course one masonry unit and one mortar joint to equal 2 5/8".
D. Maintain mortar joint thickness of 3/8".
E. Tool joints to a concave finish.
F. Do not permit mortar to drop or accumulate into cavity air space or to plug weep holes.

3.06 PLACING AND BONDING
A. Install all masonry over air barrier & rigid insulation attached to the exterior side of sheathing.
B. Lay masonry in full bed of mortar, properly jointed with other work. Buttering corners of joints, deep or excessive furrowing of mortar joints is not permitted.
C. Fully bond intersections, and external corners. Rough cut smooth ends of corner units to match face profile.
D. Do not adjust masonry units after laying. Where resetting of masonry is required, remove, clean units, and reset in new mortar.
3.07 TOLERANCES

A. Variation in Alignment from Unit to Adjacent Unit: 1/16" maximum.

B. Variation of Mortar Joint Thickness: 1/8" every 36".

3.08 REINFORCEMENT AND ANCHORAGES

A. Place bed joint reinforcement in mortar beds, spaced not greater than 16" on center vertically.

B. Attach wall ties to wood framing and sheathing for veneer at maximum 16" on center vertically and 24" on center horizontally.

C. Increase quantity of wall ties around perimeter of openings, at wall terminations and corners. Place within 8" of openings and edges of masonry.

3.09 MASONRY FLASHING

A. Extend flashing through veneer, turn up, and seal into sheathing over wood framed back-up.

B. Lap end joints a minimum of 6" and seal watertight.

3.10 CLEANING

A. Clean masonry as work progresses. Allow mortar droppings on masonry to partially dry then remove by means of brushing with a stiff fiber brush.

B. Post-Construction: Clean mock-up panel as directed below and leave for one week. If no harmful effects appear and after mortar has set and cured, clean masonry as follows:

1. Protect windows, sills, doors, trim, and other work from damage.

2. Remove large particles with stiff fiber brushes without damaging surface. Saturate masonry with clean water and flush off loose mortar and dirt.

3. Scrub with solution of 1 tsp. trisodium phosphate and 1 tsp. household detergent dissolved in 4 cups of clean water using stiff fiber brushes, then clean off immediately with clean water using hose.

4. Repeat cleaning process as often as necessary to remove mortar and other stains.
C. Use alternative cleaning solutions and methods for difficult to clean masonry only after consultation with masonry unit manufacturer.

3.11 PROTECTION

A. Protect masonry units from damage resulting from subsequent construction operations.

B. Use protection materials and methods which will not stain or damage masonry units.

C. Remove protection materials upon Substantial Performance of the Work, or when risk of damage is no longer present.

END OF SECTION
SECTION 04220

CONCRETE MASONRY UNITS

PART 1   GENERAL

1.01 DESCRIPTION

A. This Section specifies requirements for concrete masonry units, mortar and accessories.

B. Requirements for concealed flashing are found in other Division 7 Section 07620.

1.02 REFERENCES

A. The following is a listing of the publications referenced in this Section:

1. American Concrete Institute (ACI)/American Society of Civil Engineers (ASCE)/ The Masonry Society (TMS)
   a. ACI 117 Standard Specifications for Tolerance for Concrete Construction and Materials
   c. TMS 602

2. American Concrete Institute (ACI)
   a. ACI 315 Details and Detailing of Concrete Reinforcement.

3. American Society for Testing and Materials (ASTM)
   a. ASTM A 153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. ASTM A 307 Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
   c. ASTM C 90 Specifications for Load-bearing Concrete Masonry Units.
   d. ASTM C 140 Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   e. ASTM C 331 Specification for Lightweight Aggregates for Concrete Masonry Units.
f. ASTM C 426 Test Method for Linear Drying Shrinkage of Concrete Masonry Units.

g. ASTM C 549 Specification for Perlite Loose Fill Insulation

h. ASTM C 578 Specification for Rigid, Cellular Polystyrene Thermal Insulation.

i. ASTM C 744 Specification for Prefaced Concrete and Calcium Silicate Masonry Units.

j. ASTM C 1093 Practice for Accreditation of Testing Agencies for Unit Masonry.

k. ASTM C 1262 Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units.


m. ASTM D 2000 Classification System for Rubber Products in Automotive Applications.


1.03 SUBMITTALS

A. Submit the following in accordance with the requirements of “Shop Drawings, Catalog Cuts, and Samples” of Division 1 - GENERAL REQUIREMENTS (Section 01330)

B. Product Data: For each type of concrete masonry unit, mortar, and accessory including certifications that each complies with specified requirements.

C. Shop Drawings:

1. For concrete masonry units, showing sizes, profiles, coursing, bond pattern, special shape locations, joint locations and embedded items.

2. For cast stone trim in form of cutting and setting drawings, showing sizes, profiles and locations of each stone trim unit required.

3. For joint reinforcement and steel reinforcing. Detail fabrication, bending and placement of unit masonry reinforcing bars. Comply with
ACI 315 showing reinforcing bar schedules, stirrup spacing, diagrams of bent bars and arrangement of masonry reinforcing.

4. Shop Drawings and/or manufacturer's catalog cuts of dovetail slots and other devices, if any, required for anchoring masonry to steel or other materials, including instructions for their proper use.

D. Samples

1. Samples for approval for each different type and shape of exposed masonry unit required, showing full range of exposed color, texture and dimensions to be expected in the finished Work. When required by 2.01 B.6, prefaced or ground face, submit concrete masonry unit samples for color selection or verification.

2. Two sample sections of cast stone sills and coping, if any, showing color and texture of finish.

3. Samples of accessories embedded in masonry.

E. Certifications

1. Test results from qualified testing lab, certifying that masonry complies with 1.05 F.

2. Galvanizing certifications for steel hardware showing compliance with ASTM A153.

3. Material test report for anchor bolts, wire ties and anchors

F. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement

G. Construction and Installation Procedures for Cold or Hot Weather: Detailed description of methods, materials and equipment to be used to comply with cold or hot weather requirements as applicable, evidencing compliance with specified requirements.

H. Qualifications: Qualification data for firms and persons specified in 1.05 to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, telephone numbers, names of Architects/Engineers and Owners, and other information specified.
I. Quality Control Reports: Submit copies of reports verifying compressive strength requirements of completed masonry, if required by the Engineer, within 7 calendar days of the date of each completed test.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. Provide concrete masonry units that develop an installed compressive strength (f'm) of 1900 psi, unless greater compressive strengths are shown on the Contract Drawings.

B. Where fire-rated masonry construction is shown on the Contract Drawings, provide materials and construction which are identical to assemblies tested and approved by a testing and inspecting agency acceptable to the Engineer as complying with ASTM E 119, by calculated fire resistance (equivalent thickness), or by other means as permitted by authorities who would have jurisdiction if the Authority were a private corporation.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Protection of Masonry: During masonry erection, cover tops of walls, projections and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

2. Where one wythe of multi-wythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar and soil from staining the face of masonry to be left exposed or painted. Remove immediately grout, mortar or soil that comes in contact with such masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

2. Protect sills, ledges and projections from mortar droppings.

3. Protect surfaces of window and door frames and similar elements with painted and integral finishes from mortar droppings.

D. Weather Requirements
1. Conform to requirements of ACI 530.1/ASCE 6/TMS 602 for hot and cold weather construction. Follow cold weather requirements for ambient temperatures below 40 degrees F. Follow hot weather requirements for ambient temperatures above 100 degrees F, or for temperatures above 90 degrees F with wind speed above 8 mph.

2. Do not lay masonry units that are wet or frozen.

3. Remove masonry damaged by freezing conditions.

4. Erect windbreaks or enclosures when wind is 15 mph or more.

1.06 QUALITY CONTROL

A. Installer Qualifications: Installer of concrete masonry units is a certified installer with documented experience installing manufacturer’s products according to manufacturer’s specifications, on projects of similar size and complexity.

B. Inspecting Laboratory Qualifications: The Contractor-chosen independent testing laboratory must demonstrate to the Engineer’s satisfaction, based on his evaluation of laboratory-submitted criteria conforming to ASTM C 1093, that it has the experience and capability to conduct the testing indicated in this Section without delaying the progress of the Work.

C. Single Source Responsibility: Obtain exposed masonry units of uniform texture and color from a single manufacturer for each type of product required.

D. Mock-ups: Construct a panel approximately 6 foot long by 4 foot high of each type of exposed concrete masonry unit, as directed by the Engineer, for approval. Use mortar of type and color to be used in the Work.

1. Protect mock-ups from the elements with a weather-resistant membrane.

2. Retain mock-ups during construction as standards for judging completed masonry Work. When directed by the Engineer, demolish mock-ups and remove from Authority property.

3. Prepare a list of materials used to construct mock-ups, for information only, for Engineer. Include manufacturer and product names, generic materials, suppliers, colors, identifying lot or batch numbers and design mixes.

4. Where masonry is shown on the Contract Drawings to match existing, construct mock-up panel adjacent to and parallel to existing surfaces to be matched.
E. Unit Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 Specifications for Masonry Structures, except as otherwise indicated.

1. Revise ACI 530.1/ASCE 6/TMS 602 to exclude Sections 1.4 and 1.7; Parts 2.1.2, 3.1.2, and 4.1.2; and Articles 1.5.1.2, 1.5.1.3, 2.1.1.1, 2.1.1.2, and 2.3.3.9.

F. The Engineer will perform any required testing to inspect foundations for compliance with dimensional tolerances specified in ACI 117.

G. Preconstruction Testing: Employ and pay a qualified independent testing laboratory to perform the following preconstruction testing indicated as well as other inspecting and testing services required by referenced unit masonry standard or indicated herein for source and field quality control:

1. Concrete Masonry Unit Tests: Test each different concrete masonry unit shown on the Contract Drawings for dimensions, compressive strength, absorption, weight (density) and moisture content per ASTM C 140. Test exposed and/or exterior units with water repellent additive for water penetration, in accordance with the requirements of ASTM E 514.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle all materials to prevent damage by breaking, water or moisture and contamination by foreign materials.

B. Store materials on a clean, dry surface or platform, off ground, covered, separate from each other and protected from deterioration and the elements.

C. During freezing weather protect materials with tarpaulins or other suitable material.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Special Shapes: Furnish as required by the installation or as shown on the Contract Drawings.

a. Where block is furnished with integral water repellent, assemblies shall include mortar containing water repellent additive by same manufacturer.

B. Concrete Masonry Units (CMU)

1. Hollow or solid load-bearing units: ASTM C 90.

2. Weight Classification: Lightweight; except furnish normal weight for exposed CMU to be painted.

3. Unit Compressive Strength: Provide units with minimum average net area compressive strength of 1900 psi.

4. Aggregate: Lightweight aggregate, 100 percent expanded clay, shale or slate produced by the rotary kiln process and conforming to ASTM C 331. The blending of screenings or any other deleterious substances which will impair the block’s fire rating or insulation value shall not be permitted.

5. Linear Shrinkage: Maximum 0.065 percent, tested in accordance with ASTM C 426.

6. Size: Nominal 16 inch by 8 inch face dimension, unless otherwise shown on the Contract Drawings, by thickness indicated.

7. Exposed Faces

a. Color and Texture: Manufacturer's standard, unless otherwise shown on the Contract Drawings.

b. Pattern: Plain face, unless otherwise shown on the Contract Drawings.

2.02 MORTAR AND GROUT MATERIALS

A. Masonry Cement: ASTM C 91/C 91M.

1. Lehigh Hanson
2. Essroc
3. Cemex

B. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

C. Aggregate for Grout: ASTM C 404.
D. Water: Potable.

2.03 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use masonry cement mortar unless otherwise indicated.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Property Specification. Provide the following types of mortar for applications stated unless another type is indicated.
   1. For masonry below grade or in contact with earth, use Type S.
   2. For reinforced masonry, use Type S.
   3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
   4. For interior nonload-bearing partitions, Type O may be used instead of Type N.

2.04 ACCESSORIES

A. Ties and Anchors: Where shown on the Contract Drawings, furnish and install products as listed below, or approved equals. Furnish hot-dip galvanized products, unless otherwise indicated herein or shown on the Contract Drawings.
   1. Ties, if any, shall be wire ties as specified in other Sections and as shown on the Contract Drawings.
   2. Wall Anchors: Heckmann Building Products, Inc. Chicago, IL, No. 340-A, or Engineer’s approved equal; 16 gage corrugated galvanized steel, 1-1/2 inches wide by 6 inches long, or length as required, by 2 inches bend with 7/16 inch diameter hole or Engineer’s Approved Equal.
   3. Channel System Wall Anchor
      a. Channel: Hohmann & Barnard, Inc. No. 360 or No. 360-C; 10 gage galvanized steel, "Gripstay Channel" or Engineer’s Approved Equal.
      b. Anchors: Hohmann & Barnard, Inc. No. 364 or No. 365; 3/16 inch by 1-1/4 inch stainless steel, "Gripstay Anchor" or Engineer’s Approved Equal; length as shown on the Contract Drawings.
4. Anchors for Securing Masonry to Steel Columns
   b. Hohmann & Barnard, Inc., Hauppauge, NY, No. 354 or Engineer’s Approved Equal; 1-1/2 inch wide by 3/16 inch galvanized steel.

5. Anchors for Securing Masonry to Steel Beams
   a. Hohmann & Barnard, Inc. No. 357 or Engineer’s Approved Equal; 1-1/4 inch wide by 3/16 inch galvanized steel.

6. Intersecting Rigid Partition Anchors
   a. Hohmann & Barnard, Inc. No. 344 or Engineer’s Approved Equal; 1-1/4 inch wide by 3/16 inch galvanized steel, length as required.

7. Wire Mesh Wall Ties: 16 gage galvanized steel, 1/2 inch square mesh; minimum 12 inches long; width as required to provide 5/8 inch mortar cover at edges; Heckmann Building Products, Inc. No. 269, or Engineer’s approved equal.

8. Stone Anchors: Stainless steel, size and diameter as shown on the Contract Drawings; Hohmann & Barnard, Inc. No. 408, or Engineer’s approved equal.


10. Dovetail Slots: Furnish dovetail slots with filler strips, of slot size indicated, fabricated from 0.0336-inch, galvanized steel sheet. Provide the following product, or Engineer’s approved equal: No. 303 and 305, or No. 315 (where applicable) by Hohmann & Barnard or Engineer’s Approved Equal.

11. Pre-molded Control Joint Gaskets: Extruded rubber material complying with ASTM D 2000 2AA-805, durometer hardness of 80 plus or minus 5 when tested in accordance with ASTM D 2240; designed to fit CMU sash block; “No. RS Series” as manufactured by Hohmann & Barnard, Inc., or Engineer’s approved equal.
B. Compressible Filler: Pre-molded closed cell neoprene compressible filler strip with pressure sensitive adhesive; "No. NS" as manufactured by Hohmann & Barnard, Inc., or Engineer’s approved equal.

C. Weeps/Vents: Rectangular plastic tube, 1-1/2 inches by 3-1/2 inches by 3/8 inch outside width and spaced as shown on the Contract Drawings, manufactured by Hohmann & Barnard, Inc., or Engineer’s approved equal.

D. Insulation

1. Cavity Wall Insulation: Extruded Polystyrene Board Insulation: Rigid cellular thermal insulation with closed cells and integral high-density skin, formed by the expansion of polystyrene base resin in an extrusion process, CFC-free, complying with ASTM C 578, Type IV; with shiplap interlocking edges for additional air and moisture barrier protection; thicknesses as shown on the Contract Drawings.

2. Masonry Cell Insulation:
   a. Molded Polystyrene Insulation Units: Rigid, cellular thermal insulation formed by the expansion of polystyrene resin beads or granules in a closed mold to comply with ASTM C 578, Type I; furnish specially shaped units designed for installation in cores of concrete masonry units.
   b. Loose Granular Fill: Perlite complying with ASTM C 549, Type II or Type IV.

PART 3 EXECUTION

3.01 PREPARATION

A. Ensure that the foundation on which the wall is to be built has a clean, level surface free from laitance, other foreign materials, and frost or ice.

B. Verify that the foundation elevation is such that the masonry bed joint shall not vary more than 1/4 inch in 10 feet and that the foundation edge is true to line so that the masonry does not project over the edge more than 1/4 inch.

C. Clean projecting dowels and steel reinforcing to remove loose rust, scale, dirt, concrete or other material that will inhibit bond.

D. Verify that dowels and inserts for securing masonry to concrete and metal ties for securing masonry to structural steel are properly located and installed.

3.02 INSTALLATION
A. General

1. Comply with referenced unit masonry standard and other requirements indicated in this Section applicable to each type of installation included in this Contract.

2. Comply with construction site tolerances of referenced unit masonry standard.

3. Maintain uniform thickness of horizontal and vertical joints.

4. Use full-size units without cutting where possible. Where required to provide a continuous pattern or to fit to adjoining construction, cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges.

5. Cut units accurately to fit penetrations for plumbing, ducts, electrical, fire protection and communication Work, and patch holes neatly.

6. Use proper special shape units for windows, doors, bond beams, lintels, pilasters and corners with a minimum of unit cutting.

B. Laying CMU

1. Furnish and install concrete masonry units of the types and sizes shown on the Contract Drawings and which are dry, sound, clean and free from dust, dirt and cracks before laying.

2. Lay units plumb, level and true to line, with cells vertical.

3. Fully bed each concrete masonry unit in mortar with vertical joints completely filled and shove unit to a solid bearing.

4. Joint Size: Not more than 3/8 inch thick, except for PCMU which shall have 1/4 inch apparent joints.

5. Lay units in running bond pattern, unless otherwise shown on the Contract Drawings.

6. Point and tool joints in exposed concrete masonry units slightly concave with an approved jointing tool. Strike joints smooth and flush with a trowel at surfaces within wall cavity and at surfaces to be plastered, stuccoed, covered with masonry, paneling or gypsum board, or where resilient base is to be applied.

7. Where epoxy mortar joints are shown on the Contract Drawings, rake out setting mortar to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy mortar manufacturer's instructions.
8. Completely fill with mortar the hollow cores of concrete masonry units which support additional loads such as lintels, brackets, mechanical or electrical equipment, those adjacent to door frames and elsewhere where shown on the Contract Drawings. Unless units below are shown on the Contract Drawings to be filled also, install 1/4 inch square mesh grout screen to prevent grout from dripping into voids below.

9. Solidly grout longitudinal joints in two or more wythe masonry, except for cavity in cavity wall construction, if any.

10. Keep cavities clean of mortar droppings and other materials. Make provisions during laying up of cavity walls to permit the removal of mortar droppings and other debris that may fall into cavity.

11. Anchor concrete masonry unit walls to columns, beams, joists and similar structural members with anchor bolts or equivalent devices. Anchors shall be fully and solidly grouted in place. Embedment shall be not less than two-thirds of the wall thickness, unless otherwise shown on the Contract Drawings.

C. Installation of Miscellaneous Items

1. Install flashings and other sheet metal items to be incorporated in masonry as shown on the Contract Drawings, fully bedded in mortar above and below and overlapping a minimum of 4 inches at ends.
   a. Thru-wall flashing shall extend completely through wall, or shall terminate in a stainless steel drip edge.

2. Install anchor bolts, sleeves and other miscellaneous steel items to be incorporated in masonry in accordance with the Contract Drawings and approved Shop Drawings submitted under other Sections. Solidly fill spaces between such items and masonry with mortar and tool exposed joints.

D. Laying Sills and Copings

1. Set masonry sills and copings where shown on the Contract Drawings using anchors as recommended by the manufacturer in a manner so as not to affect the waterproofing integrity of the metal flashings underneath the sills and copings.

2. Install expansion joints at ends of sills and caulk joints where shown on the Contract Drawings and as specified in other Sections.
3. Install expansion joints in copings where shown on the Contract Drawings consisting of 1/2 inch joints for sealants as specified Division 7 Section 07920 on sealants.

E. Steel Reinforcing

1. If a foundation dowel does not line up with a vertical core, it shall be sloped not more than 1 inch horizontally per 6 inches vertically. Grout dowels within a core to a vertical alignment, even though it may be in a cell adjacent to the vertical wall reinforcing.

2. Where reinforcing bars are to be spliced, lap reinforcing bars by a minimum distance equivalent to 30 reinforcing bar diameters. Separate overlapping reinforcing bars by 1 bar diameter or wire together.

F. Horizontal Joint Reinforcement

1. Completely embed joint reinforcement in mortar or grout. Joints with wire reinforcement shall be a minimum of twice the thickness of the wire. Lap reinforcement 6 inches minimum at splices to contain at least one cross wire of each piece of reinforcement in the lapped area.

2. Cut or interrupt joint reinforcement at control and expansion joints.

3. Provide continuity at corners and wall intersections by use of prefabricated "L" and "T" reinforcement sections. Cut and bend reinforcement units as directed by manufacturer for continuity at returns.

G. Install control and expansion joint materials in unit masonry as Work progresses. Offset control joints from expansion joints in wythes.

H. General Grouting

1. Placement Standard: Comply with ACI 530.1/ASCE 6/TMS 602 Specifications for Masonry Structures, including requirements for pour height.

2. Place grout only after entire height of masonry to be grouted has attained proper strength to resist grout pressure. Stop grout pour 1 inch from top of masonry unit so that next pour will be keyed in.

3. Steel reinforcing shall be in place before grouting begins.

4. Vibrate, rod or puddle grout in place.

5. Keep mortar droppings out of grout spaces.
6. Maintain vertical cell alignment to preserve a continuous unobstructed cell area not less than 2 inches by 3 inches.

7. Solidly fill with grout, cells containing steel reinforcing, bolts or other anchor devices and where shown on Contract Drawings.

8. Solidly fill spaces at metal door frames and other built-in items with grout or mortar.

I. Install cavity wall insulation where shown on the Contract Drawings using adhesive type as recommended by insulation manufacturer, compatible with damp proofing or air barrier, if any.

J. Patching: Point holes and defective mortar joints in exposed masonry.
Where necessary, cut out and repoint defective joints in exposed masonry.
Patching shall match adjoining masonry in quality and appearance.

3.03 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.04 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.05 LINTELS
A. Provide concrete masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.06 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07900 "Joint Sealants" for application indicated.
   4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
   5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
   6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
   7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.07 FIELD QUALITY CONTROL
A. Place grout only after the Engineer has verified compliance of steel reinforcing grade, sizes and placement, anchorages and grout spaces with the requirements of the Section 04082 of the Specifications on steel reinforcement, as well as Contract Drawing requirements.

B. Verify compliance with compressive strength requirements of completed masonry, where shown on the Contract Drawings or as required by the Engineer.

3.08 CLEANING AND PROTECTION

A. Protect exposed masonry against staining from grouting or other sources and clean excess mortar off surfaces as the Work progresses.

B. Furnish temporary protection for door jambs and corners during the Work. Remove temporary protection when directed by the Engineer.

C. Upon completion of masonry construction, clean exposed masonry surfaces with stiff-bristled brushes and water so as to leave the masonry surfaces clean and free of mortar daubs.

D. If ordinary cleaning is not adequate, use special methods and materials to clean surfaces as approved by the Engineer.

END OF SECTION
SECTION 04815
GLASS BLOCK ASSEMBLIES

PART 1    GENERAL

1.01 DESCRIPTION
A. This Section specifies the furnishing and installation of the wall system and the glass block for same.

1.02 RELATED SECTION
1. Section 03300 – Cast-in-Place Concrete
2. Section 05500 - Metal Fabrications
3. Section 07900 - Joint Sealers
4. Section 05100 - Structural steel
5. Section 07600 - Flashing and sheet metal

1.03 REFERENCES

1.04 SUBMITTALS
A. Submit under provisions of Section 01300.
1. Each aluminum frame section- 6" long.

2. Samples of aluminum illustrating the specified finish.

3. Glazing tapes- 6" long- each type.

4. Verification Samples:
   a. Two glass block units of each type specified, showing size, design, and pattern of faces.
   b. Four block (two block by two block) representative assembly (model).

5. Product Data: Manufacturer's literature on each product to be used, including:
   a. Preparation instructions and recommendations.
   b. Storage and handling requirements and recommendations.
   c. Installation methods.

B. Shop Drawings

1. Shop drawings shall include plans, elevations, sections, and details of the system. Flashings, sealants, and anchorage details shall be clearly indicated.

2. Note gauges of brake metal, finishes of frames and hardware, and dimensions (if applicable) of work to be performed by other trades.

3. Label fastening devices as to type and spacing.

1.05 QUALITY CONTROL

A. Manufacturer

1. The drawings and specifications are based on the EXTECH Series 2100M system as manufactured by EXTECH/Exterior Technologies, Inc., or engineer’s approved equal.

2. The manufacturer for this project must have documented experience in the domestic manufacturing of aluminum framed grid systems for use with glass block systems of the general type and function as specified and/or shown in the Drawings.

B. Direct Representation
1. The manufacturer shall have available a direct representative with full knowledge and experience of the product and systems incorporated in this project to assure a quality installation.

C. Installer Qualifications: Installer of glass block framing is a certified installer with a documented experience installing manufacturer’s products on projects of similar size and scope according to manufacturer’s specifications.

1. Engage an experienced installer who has completed installations similar in design and extent to those required for this project and whose work has resulted in construction with a record of successful in-service performance.

D. Single Source Responsibility

1. Provide a prefabricated wind screen system produced by a single manufacturer.

E. Performance Characteristics

1. Design, engineer, and fabricate units to provide a wind loading capacity to meet codes, in both positive and negative directions.

2. Design the framing system to provide for expansion and contraction of component materials caused by a surface temperature range of –10 degrees F to 120 degrees F, without causing excessive buckling stresses on this glass block infill, failure of joint seals, undue stress on structural elements of the structure or any reduction in system performance.

3. The design wind speed for this particular job is 100 MPH.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle all materials to prevent damage by breaking, water or moisture and contamination by foreign materials.

B. Store materials on a clean, dry surface or platform, off ground, covered, separate from each other and protected from deterioration and the elements. Bear fully along all supported edges on level and true structural supports.

C. During freezing weather protect materials with tarpaulins or other suitable material.

D. Handle all materials in a manner which will prevent undue stress on component parts, sealants and structural members. Do not rack, torque, or
cause load forces in an inappropriate manner. Lift panels from top only unless specifically instructed by the manufacturer.

1.07 WARRANTY

A. The Manufacturer of the wall system shall warrant that, if within five (5) years from the last date of Final Acceptance, the Owner notifies the Manufacturer in writing that the wall system leaks due to defects in the system, the Manufacturer will, at its option, repair or provide replacements for those components of the system found to be defective.

B. Manufacturer will provide a "Certificate of Compliance" upon completion of installation attesting hat all components and installation conforms to the requirements on drawings and in specifications.

PART 2 Products

2.01 MANUFACTURERS


B. Pittsburgh Corning Corporation, which is located at: 800 Presque Isle Drive, Pittsburgh, PA 15239-2799; Toll Free Tel: 800-545-5001; Tel: 724-327-6100; Fax: 724-387-3806; Email: request info; Web: www.pittsburghcorning.com.

C. Or Engineer's approved equal

2.02 MATERIALS

A. Framing Extrusions.

1. Framing extrusions shall be Extech 6063-T5, 6005-T5 or 6105-T5 alloy and temper or engineer’s approved equal. All sections shall be formed to detail and free from defects impairing appearance, strength, and durability. Perimeter framing members shall not incorporate an integral structural polyurethane thermal break

2. Installer will provide compressible neoprene gasketing material at the perimeter of all extruded framing units within rough structural steel opening. Provide backer rod and sealant per Section 2.02.D below.

B. Fasteners

1. Bolts, anchors and other fastening devices shall be of approved types as required for the strength of the connections and shall be suitable
for the conditions encountered. Washers shall be of the same metals as the fasteners.

2. Exposed fasteners shall be 300 Series stainless steel and shall utilize stainless steel washers with neoprene seals.

3. Concealed fasteners shall be stainless steel or cadmium plated steel as per ASTM A-165.

C. Glazing Seals

1. Wall Assemblies shall incorporate two silicone sealant beads around the entire perimeter of each glass block glazing unit, one inside and one outside. The sealant shall be Dow #795 or an engineer’s approved equal. All seals will be backed by polyethylene or polyurethane foam tape of a type recommended by the sealant manufacturer as being compatible with the sealant.

D. Sealants

1. Those sealants between the aluminum framing and substrate shall be a one-part neutral cure silicone as recommended by the manufacturer for each specific application. Manufacturer shall be GE, Dow, or engineer’s approved equal.

E. Finish

1. The exposed surfaces of all aluminum members shall be clean and free from serious surface blemishes, scratches or tool marks. The finish shall be the following:

   a. Clear Anodic Finish: Class I (215-R1) AA-M10022A42. Thickness to be 0.7 mil and shall conform to AAMA 607.1-77

   b. Or Engineer’s approved equal.

F. Glass Block.

1. Solid Glass Block, 8X8 inches, nominal; thickness: 3.0 inches

   a. Manufacturer:

      1) Pittsburgh Corning VISTABRIK solid glass block,
      2) Circle Redmont Inc,
      3) Mulia Inc,
      4) Or Engineer’s approved equal.

   b. Pattern: Clear
G. Integral Grid System:

1. The units will consist of a structural grid work composed of extruded aluminum (6065 or 6105, T-5 or T-6). The vertical extrusions will be secured at the top and bottom, each vertical member receiving a total of four each #10 stainless steel Type A fasteners. These fasteners will pass through the head and sill extrusions and thread into the screw bosses of the vertical extrusions.

2. The horizontal structural extrusions will be in short sections fitted between the vertical extrusions. They will be secured via 3/16” diameter zinc plated steel rods which are passed through the screw bosses of the horizontal extrusions and passed through holes punched in the vertical extrusions. These rods will be secured at the extreme ends with lock nuts.

3. The structural grid shall be completely assembled at the factory.

4. After installing the assembled units, the glass blocks will be perimeter wrapped with 2” wide foam tape and inserted into the openings of the structural grid system. The foam wrapping will be sufficiently thick to hold the blocks in place temporarily.

5. Thereafter, silicone sealant will be applied around the joints between the blocks (both inside and outside). Sealant to be Dow #795 or approved equal. Color to be clear.

6. While the silicone sealant is still soft, an elastomeric joint cover strip will be embedded and snapped over the barbed edges of the structural grid extrusions. Clean off any excess exposed sealant.

PART 3 EXECUTION

3.01 INSPECTION

A. Prior to installation of the system, the installer shall examine all mounting surfaces to determine that the area is in design and dimensional agreement with the approved shop drawings.

B. In the event of an error in the substrate, the installer is to bring all deviations to the attention of the General Contractor/Owner and the glass block framing system manufacturer (in writing). No further erection work will be done until the faulty substrate has been corrected.

3.02 PREPARATION

A. Surfaces of contact between aluminum and potentially reactive dissimilar materials shall receive a protective coating to prevent electrolysis.
Protective coating shall be in the form of a bituminous coating or a polyethylene (or similar plastic) film.

3.03 INSTALLATION

A. The wall system is to be erected and glazed in accordance with manufacturer’s instructions.

B. The installer is responsible for verifying the quantities of material components as shown on delivery or packing slips.

C. The installer shall be responsible for the materials until they become a fixed part of the building. He will also be responsible for any subsequent damage which he, or others, may do to those materials, until final approval of the Work.

D. Contractor shall not install defective panels.

E. Replace any damaged glass blocks during installation or thereafter before final acceptance.

F. Do not cut, trim, or weld components during erection in any manner which would damage the finish, decrease strength, or result in a visual imperfection or a failure in performance of the work. Return components which required alteration to the shop for re-fabrication or replacement, unless specifically directed by the manufacturer to do otherwise.

G. Install components level, plumb, true to line and with uniform joints. Attach to structure with non-staining and non-corrosive shims, anchors, fasteners and spacers.

H. Provide adjustment within the work to accommodate job variations.

3.04 CARE AND CLEANING

A. The wall system shall be carefully installed to avoid damage to the metal and glass surfaces.

B. Upon completion of each phase, the installer will provide final cleaning of the exterior and interior surfaces.

END OF SECTION
SECTION 05090
METAL FASTENERS

PART 1    GENERAL

1.01    DESCRIPTION

A. The work of this section consists of the fabrication and delivery of fasteners, anchoring systems and related accessories as shown on the contract drawings and specified herein.

1.02    RELATED SECTIONS

A. Section 03600 - Grout

1.03    REFERENCES

A. American Society for Testing and Materials (ASTM):


B. Federal Specifications, FF-S-325 - Shield, expansion; Nail, Expansion; and Nail, Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4 (Wedge Expansion Anchors) Class 1 (One Piece Steel Expander with Cone Taper Integral with Stud).

1.04    SUBMITTALS

A. Provide six (6) copies of manufacturer's catalog cuts and product literature for all products including but not limited to grout, rivets, nuts, bolts, expansion bolts, screws, threaded rods, washers, and adhesive anchoring systems.

1.05    QUALITY CONTROL

A. Fabricator's Qualifications: All fabricators shall have experience in the successful completion of projects employing similar materials, applications, and performance requirements.
B. Manufacturer's Qualifications: All manufacturers shall have experience in the successful completion of projects employing similar materials, applications, and performance requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in Manufacture’s original unopened package, with brand names and material designations marked thereon.

1.07 WARRANTIES

A. The Contractor shall provide manufacturers' standard warranties for all products.

PART 2 PRODUCTS

2.01 MATERIALS

A. Drilled-in concrete anchors: Hilti HIT RE-500 injection adhesive epoxy system with stainless steel threaded rods, locking nuts and washers, or approved equal.

B. Blind rivets shall be stainless steel with domed head. Rivets shall be installed with domed head on the side with predominant view. Refer to drawings for rivet diameters.

C. Grout

1. Nonshrink, nonmetallic grout, factory packaged nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for exterior and interior applications.

2. See Specification Section 03600 - Grout

D. Adhesive Anchors: Composed of an anchor rod assembly and an anchor rod adhesive cartridge.

1. Anchor Rod Assembly: Chamfered and threaded stud rod of ASTM A325 steel with nut and washer. Stud size as indicated on Drawings.

2. Adhesive cartridge: Sealed capsule containing premeasured amounts of resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. Capsule ingredients activated by the insertion procedure of the anchor rod assembly.
3. Acceptable Manufacturers:
   a. Hilti Fastening Systems; HY70.
   b. Or approved equal.

PART 3 EXECUTION

3.01

Install anchoring systems per manufacturer’s written instructions.

END OF SECTION
SECTION 05120
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES
   A. This Section covers the design, fabrication, and installation of structural metal framing and Architecturally Exposed Structural Steel (AESS).

1.02 RELATED SECTIONS
   A. Section 03600: Grout.
   B. Section 05310: Steel Decking.
   C. Section 9900: Painting and Coating.

1.03 REFERENCES
   A. American Institute of Steel Construction (AISC):
      1. AISC 360; Specification for Structural Steel Buildings.
      2. AISC 303; Code of Standard Practice for Steel Buildings and Bridges.
   B. American National Standards Institute (ANSI):
      1. ANSI B18.22.1, Plain Washers.
   C. ASTM International (ASTM):

6. ASTM A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.


D. American Welding Society (AWS):

1. AWS D1.1 Structural Welding Code - Steel.

E. SSPC; The Society for Protective Coatings:

1. SSPC Painting Manual.

1.04 SUBMITTALS

A. Structural Steel Shop Drawings:
1. Submit shop drawings identifying the details as indicated on Drawings, indicating completely the location in the project, the size and weights of the members, the methods of joining various components, the quantity, finish, the location and type of anchors and necessary measurements.

2. Provide easy-to-read markings on shop and erection drawings for shop assemblies which require markings for erection identification.

3. Note on shop drawings variations in tolerances or clearances between various products.

4. Use standard welding symbols of the AWS on shop drawings; show size, length, and type of each weld.

5. Clearly identify all AESS members and note special quality, tolerance, and surface preparation.

6. Provide shop drawings prepared under the supervision of and sealed by a Professional Engineer licensed in the Commonwealth of Pennsylvania experienced in structural engineering.

B. Working Drawings:

1. Furnish setting diagrams, templates, and directions for the installation of structural framing anchor bolts, bearing plates, and other embedded items.

C. Project Standards:

1. Submit standards for typical beam, girder, column splices, and moment connection details prior to submitting detail drawings; standards shall be prepared under the supervision of and sealed by a Professional Engineer licensed in the Commonwealth of Pennsylvania.

D. Connection Calculations:

1. Design all connections in accordance with AISC Specifications for Structural Steel Buildings Using Allowable Strength Design.

2. Submit calculations prepared and sealed by a Professional Engineer, licensed in the Commonwealth of Pennsylvania and experienced in structural engineering.

3. Use type of shop and field connections shown or, in absence of such indication, use the most appropriate type. Connections shall
safely withstand the combined effects of shears, direct forces, moments, and torques at applicable design stresses.

4. Connection details shown on the drawings are illustrative only.

5. Design and detail connections so interference does not occur with architectural clearance lines and finishes.

6. One-sided or other eccentric connections are not permitted unless detailed on the Contract Drawings.

E. Product Data:

1. Submit data for approval related to the following:
   a. For items defined in Paragraph 2.01B this specification.
   b. Welding electrodes.
   c. Headed type studs.
   d. Paint primer.

F. Welding Certifications:

1. Prior to commencing work requiring welding, submit the procedure which will be used for prequalifying welders and welding procedures. For all procedures other than those set forth in AWS D1.1, submit a copy of procedure qualification test records.

2. Submit certified copy of qualification test record showing each welder, welding operator, and tacker who will be employed in the work has satisfactorily passed AWS qualification tests for welding procedures.

3. Submit certified copy of reports for all analyses and tests required by referenced ASTM Specifications, including test reports for filler metals for welding, and mechanical tests for high-strength threaded fasteners.

G. Test Results:

1. Submit reports signed by the manufacturer certifying their products comply with requirements specified.

2. Submit test reports certifying material conforms to ASTM specification.
3. Submit guarantee showing all steel used for this project is American-made.

4. Submit written affidavits from steel manufacturer indicating the percentage of post-industrial recycled content (90% min.) and post-consumer recycled content (75% min.).

H. Qualification Statement:

1. Submit qualification statement denoting the requirements of this specification are met by the following:
   a. Structural steel fabricator qualifications
   b. Structural steel erector qualifications
   c. Professional Land Surveyor
   d. Hot-Dip Galvanizing Company.

I. An Independent Testing and Inspection Agency (Approved Agency) shall submit inspection and testing reports required by this Section.

1.05 QUALITY CONTROL

A. Qualifications:

1. Fabricator: Company experienced in fabricating structural steel similar to that indicated for the project who has a successful in-service performance for a minimum of 5 continuous years and sufficient production capacity.
   a. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC Certified Plant with Category STD at time of bid.
   b. Fabricator shall have sufficient production capacity to produce and deliver the materials on time to meet the approved construction schedule for this Contract.

2. Erector: Company experienced in erecting structural steel work similar to that indicated for the project who has a successful in-service performance with a minimum of 5 continuous years of experience.

3. Welder, Tacker, and Welding Operator Qualifications: Use welders, tackers, and welding operators who have been previously qualified by tests as prescribed in the Structural Welding Code,
AWS D1.1 of the American Welding Society, to perform type of work required.

4. Contractors or installers of Anchoring System shall be certified or otherwise qualified by the Anchor Manufacturer verifying the necessary training has been provided to install products per Manufacturer’s requirements.

5. Land Surveyor: A surveyor licensed in the Commonwealth of Pennsylvania who is qualified to determine and verify the top of steel elevations and the edge of slab locations for each elevated framed level and to verify the structure is square, plumb, and level in accordance with AISC tolerances

6. Hot-Dip Galvanizing Plant Qualification:
   a. Company shall be a member of the American Galvanizers Association (AGA)
   b. Submit letter denoting plant location proposed for the defined work and number of years of experience performing galvanizing work similar to work denoted in this Contract.

B. Comply with applicable provisions listed in those references stated in Article 1.04 of this specification unless otherwise indicated.

C. Structural Tests and Special Inspection
   1. Materials and fabrication procedures are subject to inspection and tests in mill, shop, and field by a qualified inspection agency.
   2. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
      a. Promptly remove and replace materials or fabricated components that do not comply.
      b. Requirements for code-related Special Inspections are defined in Division 1 Specification Section.

D. AESS fabrications shall comply with specification and provisions defined in AISC “Code of Standard Practice” Section 10.
   1. Fabrications shall be examined for acceptance by the Architect in the shop prior to shipment and after installation.
1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site at such times and intervals to ensure continuity of installation and uninterrupted progress of work.

B. Store steel on platforms, skids, blocking, or other supports to prevent dirt and debris contact. Protect from exposure to conditions that produce rust.

C. Handle steel so no parts are bent, broken, or otherwise damaged and avoid damage to other material and work. Store beams with webs vertical. Exercise care to avoid scraping and over stressing the steelwork.

1. Use padded slings or other methods to avoid damage to AESS sections.

D. Mark weight on all members. Match-mark all shop pre-fitted members.

E. Ship small parts, such as bolts, nuts, washers, pins, fillers, and small connecting plates and anchors in boxes, crates, or barrels. Pack separately each length and diameter of bolt and each size of nut and washer. Plainly mark an itemized list and description of the contents on the outside of each container.

F. Replace pieces bent or damaged unless repairs are authorized by the Engineer.

1.07 JOB CONDITIONS

A. Provide anchor rods and other anchorage items to be embedded in or attached to concrete, masonry, or other materials in ample time to not delay work.

1. Furnish setting drawings, templates, and installation directions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel

1. Structural Steel: ASTM A36, ASTM A572 Grade 50, ASTM A992 Grade 50; as noted on drawings.

2. Structural Steel Rectangular (Square) HSS Tubing: ASTM A500, Grade B.

3. Structural Steel Round HSS: ASTM A500, Grade B
4. Structural Steel Pipe: ASTM A53 Grade B.

B. Fasteners

1. High-Strength Bolted Connections:
   c. Hardened Steel Washers: ASTM F436, Type 1.
   d. Direct Tension Indicators (for pretension connections): ASTM F959 Type 325.
   e. Twist-off Tension Control Bolt Assembly: ASTM F1852.

2. Fastener Assemblies
   a. Galvanized high-strength bolts and nuts are considered a manufactured assembly.
   b. Supply nuts that are lubricated
   c. The bolt, lubricated nut, and washer assembly shall be tested prior to shipment.
   d. Galvanize materials in accordance with the requirements specified in ASTM F2329.

3. Anchor Rods:
   a. Rods: ASTM F1554, Grade 36, 55, 105 as noted on drawings.

4. Bolt Lubricant: Molybdenum disulfide base lubricant

5. Adhesive Anchors:
   a. As specified in Section 03300.

C. Anchoring System:

1. Mechanical Anchoring System
a. Steel Undercut Anchors and Stainless Steel Undercut Anchors: Provide self-undercutting anchors with undercutting teeth which expands by tightening the nut. Anchors shall meet ACI 318 Appendix D requirements for cracked concrete and have approved ICC-ES Evaluation Report.

1) Acceptable manufacturers:
   a) Hilti HDA Undercut Anchor; Hilti Corporation.
   b) Simpson Strong Tie Torq-Cut™; Simpson Strong-Tie Company, Inc.
   c) Approved equal.

2. Adhesive Anchoring System: Provide adhesive anchors that meet ACI 318 Appendix D requirements for cracked concrete and that have a current approved ICC-ES Evaluation Report. The adhesive anchor setting system shall be composed of anchors and fasteners as specified, and a self-contained cartridge system capable of dispensing epoxy components in the proper mixing ratio.

   a. Anchor assembly

      1) Standard Anchor Rod Assembly: Chamfered end threaded stud rod of ASTM F1554 Grade 36 steel with nut and washer. Stud size as indicated on Drawings.

      2) Stainless Steel Anchor/Fastener: Chamfered end threaded stud rod of AISI Type 304 stainless steel, with nut and washer of AISI Type 316 stainless steel.

      3) Anchor element shall meet a tested elongation of 14% and a reduction of area of at least 30% per ACI 318 Appendix D.

   b. Adhesive Cartridge: The dual cartridge shall contain both hardener and resin and shall be dispensed from the dual cartridge through a static mixing nozzle.

      1) The pre-mixed adhesive shall be injected directly into the prepared anchor hole. The anchor/fastener shall be inserted in the adhesive in accordance with the adhesive manufacturer’s installation instructions. Only injection tools and static mixing nozzles as recommended by manufacturer shall be used.
c. Use of fast-setting epoxies is expressly prohibited.

d. Use of adhesive anchors for overhead or direct tension applications is prohibited.

e. Adhesive anchors shall not resist gravity loads in fire-rated construction.

f. Acceptable manufacturers:

1) Hilti HIT-RE 500-SD; Hilti Corporation.

2) Simpson Strong Tie SET-XP; Simpson Strong-Tie Company, Inc.

3) Approved equal.

D. Welding Electrodes:

1. AWS D1.1, E70XX.

2. Use low-hydrogen electrodes for field welding.

E. Paints and Coatings:

1. Primer Coat:

   a. Primer shall be compatible with selected finish coat.

   b. Provide a two-component, fast-curing, low volatile organic compound (VOC, metallic zinc-rich epoxy primer complying with the requirements specified in SSPC Paint 20 to steel members that do not receive intumescent finish paint coating.

2. Finish Coat: Section 09900.

3. Below Grade Coating: Coal tar epoxy.

4. Galvanizing: Hot-dip galvanize steel members, and fabrications, specified to be galvanized in accordance with ASTM A123.


   b. Repair areas damaged by welding; flame cutting; or during handling, transport, and erection by an approved method in accordance with ASTM A780.
F. Non-Shrink, Non-Metallic Grout: As specified in Specification 03600.

G. Headed Type Studs:
1. ASTM A108; weld in accordance with AWS D1.1
2. For shear connector application to floor beams, see Specification 05310.

2.02 FABRICATION

A. Fabricate structural steel in accordance with the Contract Drawings and the AISC standards referenced in Paragraph 1.03.A.

B. Perform shearing, flame cutting, and chipping carefully and accurately so as not to induce residual stress in the metal being cut.

1. Flame-cut the edges of members subjected to dynamic loading by using a mechanically guided torch or by hand, and remove all nicks.
   a. Fabricate the radii of re-entrant gas-cut fillets as large as practicable, but in no case less than ¾ inch.
   b. Perform flame cuttings so the metal is not carrying stress.
   c. Finish the exposed edges of members that were flame-cut by hand by grinding.

2. Add additional reinforcing plate as required where members are cut or coped to meet framing conditions.

C. Bolt Holes: Punch, drill, subpunch, subdrill, and ream holes for bolts as required in accordance with the requirements specified in the AISC Specifications referenced in Paragraph 1.04.A.

D. Holes for Other Work:

1. Provide holes required for securing other work to structural steel framing and for passage of other work through members as shown on final approved shop drawings.
   a. Ream, drill, or punch holes perpendicular to metal surface.
   b. Do not flame-cut holes or enlarge by burning.

2. Do not make additional openings in members not shown on final approved shop drawings unless approval to do so is received from the Engineer.
E. Mill the ends of columns and other members that transmit loads in bearing.

F. Except where welded connections are shown, use ASTM A325 bolts for shop connections.
   1. Install and tighten high-strength bolts in accordance with the requirements of the RCSC Specification for Structural Joints Using High Strength Bolts.
   2. Arrange the bolts as indicated on the Contract Drawings; or if not indicated, arrange the bolts so heads show in areas exposed to view.
   3. Clearly indicate the bolt arrangements on shop drawing submittals.

G. Welding:
   1. Perform all welding in accordance with AWS D1.1 except as modified herein.
   2. Use a welding procedure and sequence of welding that prevents needless distortion and minimizes stresses.
      a. If it is necessary to straighten transverse warpage of flanges, use controlled heating along outside face.
      b. Allow for expected weld shrinkage when laying out and assembling members in the shop.
      c. Trim members to size only when most or all of welding has been completed.
   3. Weld tabs for temporary bracing and safety cabling at points concealed from view in the completed structure.

H. Architecturally Exposed Structural Steel (AESS)
   1. Comply with requirements, including tolerance limits, defined in the AISC “Code of Standard Practice.”
   2. Fabricate and assemble AESS sections in the shop to the greatest extent possible.
   3. Fabricated section shall exhibit the following characteristics:
      a. Continuous weld appearance exhibiting uniform size and profile.
1) Groove welds flush to the surface each side within $\pm \frac{1}{16}$, -0” of plate thickness.

2) Fillet welds contoured and blended; oversize weld as required and grind to provide a smooth transition.

b. Smooth exposed surfaces free of surface blemishes such as weld splatters, slivers, and other surface discontinuities likely to show through the final coating.

c. Minimized weld show through where welding occurs on the far side of the fabrication; grind distortion to a smooth profile with adjacent material.

d. Fabrication piece marks not apparent to view.

I. Properly mark and match-mark materials to facilitate handling and field assembly.

1. Mark each member with its weight.

2. Match-mark all shop pre-fitted members.

2.03 FINISHES

A. Cleaning:

1. After fabrication, clean heavy deposits of oil and grease from unpainted steel surfaces in accordance with AISC “Code of Standard Practice.”

B. Shop Priming:

1. Surface Preparation:

   a. Clean the surfaces in accordance with the requirements of SSPC-SP3 Power Tool Cleaning following the SSPC Painting Manual.

   b. Clean “Architecturally Exposed Structural Steel" in accordance with the requirements of SSPC-SP10.

2. Primer:

   a. Immediately after surface preparation, apply the primer according to the manufacturer’s instructions and at a rate recommended by the SSPC Painting Manual to provide a dry film thickness of not less than 1.5 mils.
b. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

c. For members to receive intumescent paint, apply a primer compatible with the finish coat.

3. Refer to additional requirements specified in Section 09900.

C. Finish Coat:

1. Apply finish coats of paint to structural steel in accordance with the requirements of Section 09900.

D. Below Grade Coating:

1. Where structural steel is placed below grade, apply a coal tar epoxy coating to a total thickness of 20 mils.

E. Galvanizing:

1. For structural steel specified to be galvanized, hot-dip galvanize the steel members and fabrications in accordance with ASTM A123 and to the thicknesses specified therein.

2. Repair galvanized areas damaged caused by welding and flame-cutting and during handling, transport, and erection by using an approved repair method in accordance with ASTM A780.

F. Do not paint the following areas of structural steel members:

1. Connection plates and members where slip-critical connections are required.

2. Surfaces to be encased in concrete, except for the initial 2 inches of the length embedded.

3. Surfaces that are within ½ inch of the toe of a weld prior to welding.

4. Top flanges of beams to which metal decking or shear connectors are to be attached.

2.04 SOURCE QUALITY CONTROL

A. Materials and fabrication procedures are subject to inspection and tests by a Testing and Inspection Agency (Agency) in the mill and shop.

1. Provide the Agency with access to the places where structural steel work is being fabricated or produced so the required inspections and testing can be performed before the work is shipped.
B. Shop-Bolted Connections:

1. The Agency will inspect and test the shop-bolted structural steel connections in accordance with the AISC specifications listed in Paragraph 1.03.A.
   a. Verify proper fastening components were used and the connected elements were fabricated properly.
   b. For slip-critical and pretension connections, test 2 bolts per connection.

2. Acceptance Criteria:
   a. Verify proper fastening component used.
   b. Verify proper fabrication of connected elements.

C. Shop Welding:

1. The Approved Agency will verify all welders and welding materials being supplied under this Contract are properly certified and will conduct the inspections and tests specified.
   a. Inspect and test shop welds made during fabrication of structural steel assemblies by performing a visual inspection of the full length of all welds; inspect and test shop-welded connections in accordance with the requirements of ASTM E164 and the following:
      1) Ultrasonically inspect and test the entire length of full penetration welds in accordance with the requirements of ASTM E164 and the following:
      2) Inspect the entire length of fillet welds in accordance with the requirements for Magnetic Particle Method specified in ASTM E709 and the following:
         a) For gusset plates welded to steel members, test 25 percent of the fillet weld locations.
         b) For all other fillet weld locations, test a minimum of 10 percent of the welds.
   b. Record both the type and location of all defects found in the work, and record the work required and the work performed to correct deficiencies.
2. **Acceptance Criteria:**
   
a. Verify weld materials, locations, and types agree with Construction Documents.

b. Verify welds comply with AWS D1.1.

D. AESS fabrications shall be inspected for acceptance by the Architect in the shop prior to the shipment of those materials to the field.

E. Submit mill test reports certifying the material provided conforms to the appropriate ASTM specification.

F. Promptly remove and replace materials or fabricated components that do not comply with specified requirements.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

A. Before proceeding to erect the structural steel, verify the elevations of concrete and masonry bearing surfaces and locations of anchorages are in compliance with the Contract Documents and ready to receive the work of this Section.

B. Ensure anchor rods and other embedded items that vary in location from the dimensions shown on the Contract Drawings are positioned within the tolerances listed in the AISC Code of Standard Practice for Steel Buildings and Bridges.

C. Do not proceed with erection until unsatisfactory conditions have been corrected.

1. Immediately report errors in the structural steel, whether resulting from shop fabrication or deformation resulting from handling or transportation, which will prevent the proper erection and fitting of parts.

**3.02 INSTALLATION**

A. Adhesive Anchor Installation:

1. General: Install adhesive anchors in strict accordance with manufacturer’s published instructions and those listed in the applicable ICC-ES Evaluation Report and in accordance with the following.
2. Adhesive anchors shall not be installed in overhead and direct tension applications.

3. Install anchors only after concrete has reached its minimum specified 28-day compressive strength.

4. Anchors shall be installed in dry concrete.

5. Drilling holes: Use rotary hammer type drill and drill holes to the required diameter and depth as consistent with anchor manufacturer’s instructions for size of anchors being installed. Use carbide-tipped drill.
   
a. Prior to setting cartridge and anchor stud, clean drilled holes free of loose material. Clean holes by blowing from the back of the borehole with oil-free compressed air (min. 90 psi at 3.5 CFM), fully retracting the air extension 2 times. Brush 2 times with properly sized round steel brush. Blow again with compressed air 2 times or until return air stream is free of noticeable dust.

6. Anchor Rod Installation: Following cartridge installations in in-prepared drill holes, set anchor rod to the required depth. Set anchor rod truly perpendicular (normal) to the base plate of item being anchored.

7. Minimum Installation Criteria: Unless otherwise noted on Contract Drawings, embed adhesive anchors as shown below. Anchors shall meet the manufacturer’s published centerline to centerline spacing and edge distance requirements.

<table>
<thead>
<tr>
<th>Adhesive Anchor Diam. (Inches)</th>
<th>3/8</th>
<th>1/2</th>
<th>5/8</th>
<th>3/4</th>
<th>7/8</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedment Depth (Inches)</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>10</td>
</tr>
</tbody>
</table>

3.03 ERECTION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads.

1. Leave temporary bracing in place as long as required for safety.

2. Temporary connections required for erection of AESS members shall be made at locations not exposed to view in the final structure.
3. Handle, lift, and align AESS members using padded slings or other protective methods to maintain the appearance of section.

B. Erect steel structures plumb in the location and at the elevations shown on the Contract Drawings in accordance with the match marks, pertinent regulations, and the AISC standards referenced in Paragraph 1.03A.

1. Align column bases and bearing plates for beams and similar structural members using steel wedges or shims.

2. Do not field cut or alter structural members without the approval of the Project Manager.

3. Allow concrete foundations to cure for a minimum of 14 days before tightening anchor rod hardware.
   a. Do not tighten anchor rod hardware using impact torque wrenches.

4. Apply a coal tar epoxy coating to steel below grade.

C. Bolted Connections:

1. For connections using high-strength steel bolts, conform to requirements of the AISC Specifications referenced in Paragraph 1.03A.
   a. Assemble high-strength bolted parts so they fit solidly together when assembled.
      1) Remove scale, dirt, and other defects liable to prevent proper seating when joint surfaces are assembled, including joint surfaces adjacent to washers.
      2) Do not use gaskets or any other interposed compressible materials.
      3) Only use drift pins for bringing members into position, not to enlarge or distort holes.

2. Ensure holes are not enlarged and the metal in the vicinity of the holes is not disturbed by the drifting occurring during assembly.
   a. Enlarge holes to admit bolts for connections only if approved by the Engineer.
      1) Make the enlargement by reaming and not by burning.
2) Avoid hand reaming.

3. As erection progresses, install sufficient bolts in the work to resist dead loads, wind loads, and erection loads.
   a. Arrange and insert the bolts so bolt heads show in areas exposed to view.
   b. Perform permanent bolting when sufficient alignment has been completed to ensure as much of the structure as possible will be supported by such fastening work.

4. For bearing-type (snug-tighten) connections, tighten the ASTM A325 bolts to a snug tight condition achieved by a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench to the extent all plies of the connected material have been brought into snug contact.

5. For slip-critical and pretension connections, tighten the ASTM A325 bolts, nuts, and direct tension indicators or twist-off-type tension control bolt in accordance with the AISC specifications listed in Paragraph 1.03A.
   a. Clean oil, paint, or lacquer from the contact surfaces of slip-critical joints.
   b. Place direct tension indicators under either the bolt head or the hardened washer.
      1) If direct tension indicators are placed under the turned element, place a hardened round steel washer between the direct tension indicator and the turned element.
   c. To ensure proper tensioning of these connections is achieved, have a representative from the direct tension indicator supplier on site during their initial tightening to witness and approve of the degree of tightening.

D. Field Welding:

1. Provide only where approved by the Engineer or as indicated in the approved shop drawings.
   a. Securely tighten erection bolts used in welded construction and leave them in place.
b. Field welding rigid frame flange connection plates on columns may only be performed if required for ease of erection and must be clearly indicated on the approved shop drawings and approved by the Engineer.

E. After the supported members have been aligned and properly positioned and the anchor nuts have been tightened, dry-pack the entire area under bearing plates with non-shrink non-metallic grout.

1. Do not place concrete on steel structure until the grout is in place and anchor bolts have been tightened.

F. Prior to installing metal decking, clean all heavy rust, mill scale, dirt, or other materials from unpainted top flanges of supporting beams.

G. Erected (in-place) AESS fabrications shall exhibit the same characteristics denoted in Section 2.02H of this section.

1. All bolt heads shall be oriented to one side; where only one side of connection is exposed to final view, orient heads to that exposed side.

3.04 FIELD QUALITY CONTROL

A. An Independent Testing and Inspection Agency (Agency) shall be engaged to inspect high-strength bolted connections and welded connections, to perform the specified tests, and interpret the test results; to confirm the structure is square, plumb, and level in accordance with AISC tolerances, including special tolerances for AESS; and to prepare and submit test reports for this work.

B. Field-Bolted Connections:

1. The Agency will inspect and test field-bolted structural steel connections in accordance with AISC specifications listed in Paragraph 1.03A and as specified.

   a. Verify proper fastening components were used and the connected elements were fabricated properly.

   b. Slip-critical and pretension connections: test 2 bolts per connection.

C. Field Welding:

1. The Approved Agency will verify all welders and welding materials in the field are properly certified and will conduct the inspections and tests specified.
a. Inspect and test field welds, in accordance with the requirements of AWS D1.1, made during erection of structural steel assemblies by performing a visual inspection of the full length of all welds and the following:

1) Ultrasonically inspect and test the entire length of full penetration welds in accordance with the requirements of ASTM E164 and the following:

   a) For all groove and full-penetration welds, test all welds.

2) Inspect the entire length of fillet welds in accordance with the requirements for the Magnetic Particle Method specified in ASTM E709 and the following:

   a) For all fillet weld locations, test all welds.

b. Record both the type and location of all defects found in the work, and record the work required and the work performed to correct deficiencies.

2. Acceptance Criteria:

   a. Verify welds comply with the requirements specified in AWS and ASTM specifications will be acceptable.

   b. Verify welders and welding materials are properly certified.

D. Verification of Conditions

1. Have the Professional Land Surveyor survey each elevated framed level to determine the top of steel elevations and the edge of slab locations, and verify that the structure is square, plumb, and level in accordance with AISC tolerances, including special tolerances for AESS.

   a. Submit a certified copy of the Professional Land Surveyor’s survey denoting top of steel elevations and the edge of slab locations for approval.

2. Verify only erectors qualified as specified herein erect the structural steel.

3.05 REPAIR/RESTORATION

A. Remove and replace work that does not comply with specified requirements.
1. Correct deficiencies in structural steel work that inspections and test reports have indicated to be not in compliance with requirements.

2. Additional tests performed by the Testing Agency to reconfirm any noncompliant original work and verify compliance of corrected work will be performed at no additional cost to the Owner.

B. Immediately after erection, clean field welds, bolted connections, and areas where shop paint is abraded; prime them with paint of the same quality as that used for the shop coat in accordance with the requirements specified in Section 09900.

1. Repair galvanized areas damaged caused by welding and flame-cutting and during handling, transport, and erection by using an approved repair method in accordance with ASTM A780.

C. Apply touch-up paint to exposed areas using material as specified in Section 09900.

1. Completely blend touch-up paint with adjacent surfaces on AESS members.

3.06 NON-CONFORMING WORK

A. Non-Conforming Work

1. Promptly remove and replace Work that does not comply with specified requirements.

   a. Correct deficiencies in the Work that inspections and test reports have indicated to be not in compliance with requirements.

2. Record the work required and the work performed to correct deficiencies in field welding.

3. Depending on the amount of non-conforming work encountered, the amount of testing required may be modified.

END OF SECTION
SECTION 05310
STEEL DECK

PART 1 GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES
A. This Section specifies furnishing and installing steel floor decking at locations indicated on the Drawings.

1.03 RELATED WORK
A. Section 03300: Cast-in-Place Concrete.

1.04 REFERENCES
A. American Iron and Steel Institute (AISI):
   1. Specification for the Design of Cold-Formed Steel Structural Members.

B. ASTM International (ASTM):
   1. ASTM A653; Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. American Welding Society (AWS):
   1. ANSI/AWS D1.1 Structural Welding Code—Steel.
   2. ANSI/AWS D1.3 Structural Welding Code—Sheet Metal.

D. Steel Deck Institute (SDI):
1. Design Manual for Composite Decks, Form Decks and Roof Decks (Publication #30).

E. U.S. Government

1. Occupational Safety and Health Administration (OSHA):
   a. 29CRF 1926 Safety and Health Regulations for Construction.

1.05 SYSTEM DESCRIPTION

A. Compute structural properties of roof and floor deck sections in accordance with the American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members.

1.06 SUBMITTALS

A. Manufacturer's specifications and installation instructions for product specified. Include manufacturer's certification as may be required to show compliance with these specifications.

   1. Non-composite steel floor decking.

B. Detailed drawings showing layout of deck panels, anchorage details and every condition requiring closure panels, special jointing or other accessories.

C. Welder Certificates: Submit certificates certifying welders, employed on the work, have passed AWS qualifications within the previous 12 months.

1.07 QUALITY CONTROL

A. Codes and Standards:

   1. Comply with the provisions of the following codes and standards, except as otherwise shown or specified:

      a. American Iron and Steel Institute (AISI):

         1) Specification for the Design of Cold-Formed Steel Structural Members.

      b. American Welding Society (AWS):

         1) ANSI/AWS D1.3, Structural Welding Code - Sheet Metal.

      c. Steel Deck Institute (SDI):
1) Design Manual for Composite Decks, Form Decks and Roof Decks.


B. Installer Qualifications: Engage an experienced Installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

C. Welding Standards: Comply with applicable provisions of AWS D1.1 Structural Welding Code—Steel and AWS D1.3 Structural Welding Code—Sheet Steel.

1. Certify each welder has satisfactorily passed AWS qualification tests within the last twelve (12) months for welding processes involved and, if pertinent, has undergone recertification.

D. The completed deck installation shall be ready for the placement of concrete with only an allowance for minor alterations due to small floor penetrations that need to be coordinated with the mechanical, plumbing, and electrical disciplines. All closure sections, pour stops, and edge bent plates shall be installed. All deck edges shall be adequately supported and capable of supporting the weight of concrete and construction loading without additional deck alterations.

1. At columns, install supplemental materials of sufficient strength to provide fall protection for personnel and to prevent objections from falling through to lower level.

E. A Testing and Inspection Agency shall submit inspection and testing reports required by this specification. Reports shall include data on type(s) of tests and inspections conducted, and test and inspection results.

1.08 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Storage: Store decking on platforms, skids, blocking or other supports with one end elevated. Protect from weather with non-asphaltic waterproof covering, adequately ventilated to prevent condensation.

B. Protection: Exercise care so as not to damage decking during handling or rigging.

1. Do not use decking for storage or as a working platform for other construction materials. This requirement applies to bulk storage.
2. Exercise care so as not to overload decking during installation and during the entire construction period.

3. Do not place deck bundles on unbolted building frames.

PART 2 PRODUCTS

2.01 MATERIALS

A. Floor Deck:

1. Non-composite Steel Floor Deck: Fabricate panels conforming to SDI Publication No. 30 Design Manual for Composite Decks, Form Decks and Roof Decks, the minimum section properties indicated, and the following:

   a. Steel Sheet: ASTM A653, Structural Quality Grade 33 or higher, that receive a galvanized coating conforming to ASTM A924, G90 coating.

   b. Profile Depth: 1½ inches.

   c. Design Uncoated-Steel Thickness: 0.0358 inch.

   d. Span Condition: Triple span or more.

   e. Side Joints: Overlapped.

B. Accessories:

1. General: Provide accessory materials for steel deck that comply with requirements indicated and recommendations of the steel deck manufacturer.

2. Mechanical Fasteners: Manufacturer’s standard, corrosion-resistant, low-velocity, powder-actuated or pneumatically driven carbon steel fasteners; or self-drilling, self-threading screws.

3. Rib Closure Strips: Manufacturer’s standard vulcanized, closed-cell, synthetic rubber.

4. Pour Stops: Steel sheet, of same material as deck panels, and of thickness and profile indicated.

5. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material and thickness as deck panels, unless otherwise indicated.
6. Weld Washers: Manufacturer’s standard uncoated-steel sheet weld washers, shaped to fit deck rib, 0.0598-inch thick with ¾-inch minimum diameter pre-punched hole.

7. Steel Sheet Accessories: ASTM A653 Structural Quality minimum yield strength of 33ksi, G 60 coating class, galvanized according to ASTM A924.


2.02 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following or equal as approved by the Architect:

1. United Steel Deck, Inc.

2. Vulcraft Group, Div. of Nucor Corp.

3. Or approved equal.

2.03 FABRICATION

A. General: Place deck units in lengths to span 3 or more supports with interlapping side laps, unless otherwise indicated. Provide deck configurations complying with SDI Basic Design Specifications, and as specified herein.

B. Provide decking free of lubricants and oils.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine supporting framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of steel deck.

3.02 PREPARATION

A. Locate decking bundles to prevent overloading of supporting members.
3.03 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary of SDI Publication No. 30, manufacturer’s recommendations, and requirements of this Section.

B. Place deck panels on supporting framing and adjust to final position with ends accurately aligned and bearing on supporting framing before being permanently fastened.

C. Place deck panels flat and square and fasten to supporting framing without warp or deflection. Provide miscellaneous steel, as required, at columns and at beam/column moment connections to adequately support weight of construction loadings.

D. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to the decking.

E. Openings in Floor Decking: Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work as follows.

1. Opening with 6-inch to 12-inch dimension in any direction: Reinforce decking around opening by means of a steel sheet placed over the opening on the top of the decking and fusion welded to the top surface of the deck. Provide sheet steel of the same quality as the deck units, at least 12 inches wider and longer than the opening, unless otherwise indicated. Space welds at each corner and not more than 12 inches on center along each side.

2. Opening greater than 12 inches but less than 18 inches in any direction: reinforce decking with steel above, as noted above, and provide 2 #4 each side of opening unless noted on contract drawings.

3. Opening with 18-inch or greater dimension: Additional miscellaneous structural steel members shall be provided at all sides of opening as shown on Contract Drawings.

4. Where several openings occur close together, an attempt should be made to space the openings such that penetration can be to examine individually. If the following criterion is not met, the openings shall be treated as a long slot with a dimension equal to the distance between the outer edges of the outermost penetration.

   a. Series of openings each less than 6 inches: provide a minimum of 12 inches clear between the openings (center to
center penetration equals the larger opening diameter plus 12 inches).

b. Series of openings greater than 6 inches but less than 10 inches: provide a minimum of 18 inches between penetrations.

c. Series of openings greater than 10 inches but less than 18 inches: the Architect must be notified of location.

5. Unscheduled openings through the deck shall not be cut without approval of the Project Manager.

6. If questions occur related to the type/amount of reinforcement to be provided at floor openings, contact the Project Manager prior to concrete placement.

F. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

G. Do not leave deck unattached at the end of day’s work.

3.04 FLOOR DECK INSTALLATION

A. Fasten floor deck panels to steel supporting member by fusion welds indicated or elongated weld of equal strength:

1. Weld Diameter: \( \frac{5}{8} \)-inch nominal.

2. Weld Spacing: Weld edge ribs of panels at each support. Space additional welds a maximum of 12 inches apart.

   a. Weld Washers: Install weld washers at each weld location where recommended by the deck manufacturer.

B. Side Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels spaced no more than 24 inches using the following method:

   1. Mechanically fasten with self-drilling No. 10 diameter or larger carbon steel screws.

C. End Bearing: Install deck ends over supporting framing with a minimum end bearing of 1½ inches, with end joints butted.

D. Pour Stops: Weld steel sheet pour stops to supporting structure according to SDI recommendations, unless otherwise indicated.
E. Floor Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck according to SDI recommendations to provide tight-fitting closures at open ends of ribs and sides of decking. Weld cover plates at changes in direction of floor deck panels, unless otherwise indicated.

F. Hangars:

1. For mechanical, plumbing, and electrical, install adjustable metal deck hanger rod assembly in deck prior to placement of slab concrete. Maximum load and minimum spacing is defined on the Contract Drawings.

G. Concrete Slab Placement: for Overpass Bridge Slab

1. Prior to concrete replacement, remove all soil, debris, standing water, loose mill scale, and other foreign matter.

2. Determine need for temporary shoring of deck prior to concrete placement; see contract drawings for guidelines.

3. For slab placement and finishing requirements, see Specification 03300 and the Contract Drawings.

3.05 SITE QUALITY CONTROL

A. A Testing and Inspection Agency (Agency) shall perform field inspections, quality control testing, and prepare test reports.

1. The Agency shall conduct and interpret test results.

2. Written reports on all tests and inspections shall be provided immediately after work is performed. The reports shall state test specimens either comply with requirements or deviate from them.

B. Visually inspect all field welds and mechanical fasteners installed for anchorage of decking.

C. Non-Conforming Work

1. Remove and replace work that does not comply with specified requirements.

2. The Contractor shall correct deficiencies in steel deck work that inspections and test reports have indicated to be not in compliance with requirements. The Agency will perform additional tests, at the Contractor's expense, as necessary to reconfirm any
noncompliance of original work and to show compliance of corrected work.

3.06 REPAIRS AND PROTECTION

A. Deck areas subjected to heavy or repeated construction traffic shall be adequately protected by planking or other means to avoid overloading and/or damage.

1. Damaged deck shall be repaired or replaced prior to placement of concrete.

B. Upon completion of decking placement, and prior to placement of topping materials, inspect for tears, dents or other damage that may prevent the deck from acting as a form or diaphragm. Repairs or replacement shall be made prior to placement of topping materials.

C. Galvanizing Repairs: Prepare and repair damaged galvanized coatings with galvanized repair paint according to ASTM A780 and the manufacturer’s instructions.

D. Provide final protection and maintain conditions to ensure steel decking is without damage or deterioration at time of completion.

END OF SECTION
SECTION 05400
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements apply to this Section.

1.02 DESCRIPTION

A. This Section includes the following:
   1. Exterior non load-bearing wall framing.
   2. Interior non load-bearing wall framing.
   3. Ceiling joist framing.
   4. Soffit Framing

B. Related Sections include the following:
   1. Section 05500 - "Metal Fabrications" for masonry shelf angles and connections.
   2. Section 09290 - "Gypsum Board"
   3. Section 06200 – “Finish Carpentry”

1.03 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.

B. Design Loads: As indicated on structural drawings

C. Deflection Limits: Design framing systems to withstand design loads without deflections greater than required by applicable codes.

D. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
E. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

F. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."

G. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."

H. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.04 SUBMITTALS

A. Product Data: For each type of cold-formed metal framing product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Cold-formed metal framing to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer, in the state of Pennsylvania, responsible for their preparation.

D. Welding certificates.

E. Qualification Data: For installer, professional engineer and testing agency.

F. Product Test Reports: From a qualified testing agency, unless otherwise stated, indicating that each of the following complies with requirements, based on evaluation of comprehensive tests for current products:

1. Steel sheet.
2. Expansion anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips.
7. Miscellaneous structural clips and accessories.
1.05 QUALITY CONTROL

A. Installer Qualifications: Installer of cold-formed metal framing is a certified installer with experience installing manufacturer’s products according to manufacturer’s specifications, on at least 10 projects of similar size and scope.

B. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

C. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated.

E. Product Tests: Mill certificates or data from a qualified independent testing agency, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.


G. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

H. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section 01315 Meetings.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver, store and handle all materials to prevent damage by breaking, water or moisture and contamination by foreign materials.

B. Store materials on a clean, dry surface or platform, off ground, covered, separate from each other and protected from deterioration and the elements. Bear fully along all supported edges on level and true structural supports. Ventilate to avoid condensation.

C. Handle all materials in a manner which will prevent undue stress on component parts, sealants and structural members. Do not rack, torque, or cause load forces in an inappropriate manner. Lift panels from top only unless specifically instructed by the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.
2. AllSteel Products, Inc.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
15. SCAFCO Corporation.
18. Steeler, Inc.
20. United Metal Products, Inc.
21. Or Engineer’s Approved equal

2.02 MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60.

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G90 (Z275).

2.03 NON-LOAD BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
   2. Flange Width: 1-5/8 inches (41 mm)

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
   2. Flange Width: 1-1/4 inches (32 mm)
C. **Steel Box or Back-to-Back Headers**: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
2. Flange Width: 1-5/8 inches (41 mm)

### 2.04 CEILING JOIST FRAMING

A. **Steel Ceiling Joists**: Manufacturer's standard C-shaped steel sections, of web depths indicated, unpunched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
2. Flange Width: 1-5/8 inches (41 mm) See drawings

### 2.05 SOFFIT FRAMING

A. **Exterior Soffit Frame**: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm)
2. Flange Width: 1-5/8 inches (41 mm), minimum.

### 2.06 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers, knee braces, and girts.
9. Joist hangers and end closures.

2.07 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 55, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.08 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, and plasticizing and water-reducing.
agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, nonleaching.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer’s standard widths to match width of bottom track or rim track members.

2.09 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI’s specifications and standards, manufacturer’s written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.

2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

B. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

1. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

2. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

C. Squareness: Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 EXECUTION
3.01 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed metal framing according to AISI’s "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer’s written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

   a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work. Retain subparagraph above and subparagraph below if using mechanical fasteners.

   b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.

I. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

   1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.03 NON – LOAD BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

   1. Anchor Spacing: To match stud spacing.

C. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

   1. Stud Spacing: 16 inches (406 mm)

D. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar configurations.

E. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

F. Align floor and roof framing over studs. Where framing cannot be aligned, continuously reinforce track to transfer loads.
G. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

H. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.

2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

I. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer’s written recommendations and industry standards in each case, considering weight or load resulting from item supported.

J. Install horizontal bridging in stud system, as indicated on Shop Drawings. Fasten at each stud intersection.

K. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

L. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.04 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:

D. Joist Spacing: 16 inches.

E. Frame openings with built-up joist headers consisting of joist and joist track, nesting joists, or another combination of connected joists if indicated.

F. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.

1. Install web stiffeners to transfer axial loads of walls above.

G. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:

1. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

H. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

I. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.05 FIELD QUALITY CONTROL

A. Testing: Contractor will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Engineer.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.
E. Additional testing and inspecting, at Contractor’s expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.06 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer’s written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, which ensures that the cold-formed metal framing is without damage or deterioration at time of Final Acceptance.

END OF SECTION
SECTION 05500

METAL FABRICATIONS

PART 1   GENERAL

1.01   DESCRIPTION

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.

1. Support for Wall Mounted Items
2. Shelf Angles
3. Decorative Wall Brackets
4. Metal Downspout Boots
5. Steel fixed ladder at elevator pit.

C. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.02   RELATED SECTIONS

A. Section 04200 - "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.

B. Section 05120 - "Structural Steel."

C. Section 09900 – “Painting”.

D. Section 12504 - "Bicycle Rack"

1.03   SUBMITTALS

A. Submit in accordance with Section 01300 – Submittals.
B. Shop Drawings:
   1. Each item specified, showing complete detail, location in the project, material, and size of components, method of joining various components and assemblies, finish, and location, size, and type of anchors.
   2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
   3. Provide templates and rough-in measurements as required.

C. Manufacturer's Certificates:
   1. Live load designs as specified.

D. Welding certificates.

E. Design Calculations for specified live loads including dead loads.

F. Qualification Data: For professional engineer.

G. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.04 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.05 QUALITY CONTROL

A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

B. Assemble products to the greatest extent possible before delivery to the site.

C. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer’s standard commercial product.

D. Employ a professional engineer competent in design and structural analysis to fabricate ladders and other metal fabrications in compliance with industry standards and local codes.
1.06 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American Society of Mechanical Engineers (ASME):
   2. B18.2.2-87(R2005) Square and Hex Nuts

C. American Society for Testing and Materials (ASTM):
   1. A 36/A 36M-05: Structural Steel
   3. A 48-03: Gray Iron Castings
   4. A 53-06: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
   5. A 123-02: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   7. A 269-07: Seamless and Welded Austenitic Stainless Steel Tubing for General Service
   8. A 307-07: Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
   9. A 312/A 312M-06: Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
   10. A 391/A 391M-01: Grade 80 Alloy Steel Chain
   11. A 653/A 653M-07: Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process
   12. A 786/A 786M-05: Rolled Steel Floor Plate
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<td>14.</td>
<td>B 221-06: Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes</td>
</tr>
<tr>
<td>16.</td>
<td>B 632-02: Aluminum-Alloy Rolled Tread Plate</td>
</tr>
<tr>
<td>17.</td>
<td>C 1107-07: Packaged Dry, Hydraulic-Cement Grout (Nonshrink)</td>
</tr>
<tr>
<td>18.</td>
<td>D 3656-04: Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns</td>
</tr>
<tr>
<td>19.</td>
<td>F 436-07: Hardened Steel Washers</td>
</tr>
<tr>
<td>20.</td>
<td>F 468-06: Nonferrous Bolts, Hex Cap Screws, and Studs for General Use</td>
</tr>
<tr>
<td>21.</td>
<td>F 593-02: Stainless Steel Bolts, Hex Cap Screws, and Studs</td>
</tr>
<tr>
<td>22.</td>
<td>F 1667-05: Driven Fasteners: Nails, Spikes, and Staples</td>
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<td>D. American Welding Society (AWS):</td>
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<td>2. D1.2-03: Structural Welding Code Aluminum.</td>
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<td>E. National Association of Architectural Metal Manufacturers (NAAMM)</td>
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<td>1. AMP521-01 Pipe Railing Manual</td>
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<td>2. AMP 500-505-1988 Metal Finishes Manual</td>
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<td>3. MBG 531-00 Metal Bar Grating Manual</td>
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<td>4. MBG 532-00 Heavy Duty Metal Bar Grating Manual</td>
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<td>F. Structural Steel Painting Council (SSPC):</td>
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<td>1. SP 1-05 No. 1, Solvent Cleaning</td>
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<td>2. SP 2-05 No. 2, Hand Tool Cleaning</td>
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3. SP 3-05 No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):

1. RR-T-650E Treads, Metallic and Nonmetallic, Nonskid
   Codes and Standards: In addition to complying with applicable Building Codes
   and regulations, comply with ANSI A 14.3, ANSI A 12.1, ANSI A58.1,
   and OSHA as applicable to stairs, ladders, railings and protection of floor
   openings.

H. Occupational Safety and Health Administration (OSHA):

1. 1910.27 – Fixed Ladders.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in protective wrappings with each item labeled
   with installation location.

B. Deliver, store and handle all materials to prevent damage by
   breaking, water or moisture and contamination by foreign materials.

C. Store materials on a clean, dry surface or platform, off ground,
   covered, separate from each other and protected from deterioration
   and the elements. Bear fully along all supported edges on level and
   true structural supports. Ventilate to avoid condensation.

D. Handle all materials in a manner which will prevent undue stress on
   component parts, sealants and structural members. Do not rack,
   torque, or cause load forces in an inappropriate manner. Lift
   panels from top only unless specifically instructed by the
   manufacturer.

PART 2 PRODUCTS

2.01 STEEL LADDERS:

A. Manufacturers: Subject to compliance with requirements, provide
   products of the following:

   1. Worthington Metal Fabricators
   2. Lapeyre Stair Inc.
   3. ACL Industries, Inc.
   4. ALACO Ladder Company
   5. Or approved equal.

B. Ladder
1. Space side rails 16 inches apart unless otherwise indicated.
4. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
7. Galvanize ladders, including brackets.

2.02 DESIGN CRITERIA

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

2.03 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

C. Steel Plates, Shapes, and Bars: ASTM A 36.

1. Rolled Steel Floor Plate: ASTM A 36

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53.standard weight (schedule 40) unless otherwise indicated

1. Galvanized for exterior locations.

2. Type S, Grade A unless specified otherwise.

3. NPS (inside diameter) as shown.
F. Cast Iron: Either gray iron, ASTM A 48, or malleable iron, ASTM A 47, unless otherwise indicated.

2.04 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.

2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

2.05 FASTENERS:

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.

2. Provide stainless-steel fasteners for fastening stainless steel.


4. Provide bronze fasteners for fastening bronze.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

C. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.

D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1 (A1).

E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

F. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

G. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

H. Post-Installed Anchors: chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.


3. Blind Bolts: Type HB – Hollo Bolt, or approved equal

2.06 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09900 "Finishes"

B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107
Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.07 FABRICATION GENERAL

A. Material

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.

2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed work with accurate angles and surfaces and straight edges.

F. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing. Weld in accordance with AWS.

5. Welds shall show good fusion, be free from cracks and porosity, and accomplish secure and rigid joints in proper alignment.
6. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.

7. Finish welded joints to match finish of adjacent surface.

G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

1. Miter or butt members at corners.

2. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.

H. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

I. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

1. Accurately cut, machine, and fit joints, corners, copes, and miters.

2. Fit removable members to be easily removed.

3. Design and construct field connections in the most practical place for appearance and ease of installation.

4. Fit pieces together as required.

5. Fabricate connections for ease of assembly and disassembly without use of special tools.

6. Joints firm when assembled.

7. Conceal joining, fitting, and welding on exposed work as far as practical.

8. Do not show rivets and screws prominently on the exposed face.
9. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

J. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.

2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.

3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.

4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.

5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts, except where otherwise specified.

K. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

L. Size:

1. Size and thickness of members as shown.

2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

M. Connections
1. Except as otherwise specified, connections may be made by welding, riveting or bolting.

2. Field riveting will not be approved.

3. Design size, number, and placement of fasteners, to develop a joint strength of not less than the design value.

4. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.

5. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.

6. Use stainless steel connectors for removable members machine screws or bolts.

N. Workmanship

1. General:
   a. Fabricate items to design shown.
   b. Furnish members in longest lengths commercially available within the limits shown and specified.
   c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
   d. Provide holes, sinkages, and reinforcement shown and required for fasteners and anchorage items.
   e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
   f. Prepare members for the installation and fitting of hardware.
   g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
   h. Fabricate surfaces and edges free from sharp edges, burrs, and projections which may cause injury.
O. Finish:

1. Finish exposed surfaces in accordance with NAAMM Metal Finishes Manual.

2. Steel and Iron: NAAMM AMP 504.
   a. Zinc coated (Galvanized): ASTM A 123, G90 unless noted otherwise.
   b. Surfaces exposed in the finished work:
      1) Finish smooth rough surfaces and remove projections.
      2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.
   c. Shop Prime Painting:
      1) Surfaces of Ferrous metal:
         a) Items not specified to have other coatings.
         b) Galvanized surfaces specified to have prime paint.
         c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.
         d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.
         e) After cleaning and finishing apply one coat of primer as specified in Section 09900 – Painting.
      2) Non ferrous metals: Comply with NAAMM-500 series.

P. Protection:

1. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.
2.08 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports where indicated.

D. Prime miscellaneous framing and supports with primer specified in Section 09900

2.09 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize and prime shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with primer specified in Section 09900 "Painting."

2.10 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.

1. Outlet: as indicated on drawings

B. Prime cast-iron downspout boots with zinc-rich primer.
2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

C. Prime plates with zinc-rich primer

2.12 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

C. Galvanize and prime loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with primer specified in Section 09900 "Painting."

2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153 for steel and iron hardware and with ASTM A 123 for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 09900 "Painting"

D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:


4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

F.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack & twist, set parallel or perpendicular as required to line and plane of surface and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-
dip galvanized after fabrication and are for bolted or screwed field connections.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

1. Provide temporary bracing for such items until concrete or masonry is set.

2. Place in accordance with setting drawings and instructions.

3. Build strap anchors into masonry as work progresses.

D. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.

E. Field weld in accordance with AWS.

1. Design and finish as specified for shop welding.

2. Use continuous weld unless specified otherwise.

F. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Expansion Anchors should be used where shown on the drawings and elsewhere except where shown otherwise. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

G. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

H. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

3.02 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchorage to structure.
1. Secure angles and clips to structure as shown or as required.

2. Secure supports to mid height of concrete beams when inserts do not exist with expansion anchors and to slabs, with expansion anchors unless shown otherwise.

3. Secure steel plate and steel angles to slabs or masonry walls, with expansion anchors unless shown or specified otherwise.

3.03 INSTALLING BEARING AND LEVELING PLATES


B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 CLEAN AND ADJUSTING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09900 "Painting"

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

D. Clean after installation exposed pre-finished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

END OF SECTION
SECTION 05520
HANDRAILS AND RAILINGS

PART 1    GENERAL

1.01    DESCRIPTION

A. Provide all labor and materials to shop fabricate steel assemblies as shown on the drawings and described herein.

1. This is a Standard SEPTA Specification for the following shop fabricated steel assemblies; guardrails, handrails, steel windscreen frames, and sign frames.

2. All items shall be shop assembled, hot-dipped galvanized and painted. Where an item cannot be totally shop fabricated it shall be fabricated in as large of sections as possible and field assembled using bolted connections. Field welding and/or welding after the sections have been galvanized is unacceptable.

1.02    RELATED SECTIONS

A. GENERAL:

1. Refer to Section 01401 – Quality Requirements.

1.03    REFERENCES

A. ASTM A 500 - Grade B cold formed welded and seamless carbon steel structural tubing.

B. ASTM A 53 - Grade B hot-dipped, zinc coated welded and seamless steel pipe.


D. AISI-General and AISI-NAS - Specification for cold-formed carbon or low-alloy steel, structural and nonstructural steel framing.


F. ASTM A 123 and A 153 Zinc-coating (hot-dip) on assembled steel products & hardware.

G. ASTM A 386 - Zinc-coating on assembled steel products.
H. ASTM D 6386 - Standard practice for preparation of zinc (hot-dip galvanized) coated iron and steel product and hardware surfaces for painting.

I. SSPC (Steel Structural Painting Council) - Steel structural painting manual.

J. AWS D1.1 - American Welding Society Standards.


1.04 SUBMITTALS

A. Shop Drawings: Provide (6) copies of all shop drawings indicating profiles, sizes, connections, attachments, welds, vent holes for galvanizing, anchorage, size and type of fasteners, and accessories.

1. Shop Drawings shall be drawn to a scale that clearly shows all design and fabrication details. This shall include but not be limited to welding symbols showing weld type, size, and spacing. In addition, detailed information must be included on the spacing and sizes of the holes required for the hot-dip galvanizing process. Material component schedules must be included with the shop assembly drawings.

2. When the product requires field assembly the contractor must supply detailed assembly drawings that are keyed to the labeled boxes in which the products shall be shipped along with all fasteners. Fasteners must be stainless steel and tamperproof. All boxes, cartons, pallets, and/or skids shall be clearly marked with its contents.

B. Samples: Provide (3) 6" long or square samples which will show adequately the quality of fabrication and finish as specified herein. All steel samples shall be hot-dip galvanized and painted per the specification. All finishes on the delivered products shall be judged against these samples. Half the sample shall be bare galvanized finish while the remaining half will be painted over the galvanized finish to show the both the galvanization and painting qualities.
1. Provide (3) samples of elbow, and tee, connections along with wall brackets, escutcheon, and end stops for the handrails.

2. Provide (3) samples of all fasteners including, washers, threaded rods, bolts, and nuts.

C. Certifications: Provide (6) copies of mill certifications, welder qualifications and welding procedure qualifications.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package so that products will not be damaged during shipping or storage.

B. Clearly label each package of contents. Label shall be on (2) ends and (1) face. Contents shall be labeled and coordinated with installation drawings.

C. Ship items to SEPTA location as described in purchase requisition.

1.06 QUALITY ASSURANCE AND CONTROL

A. Fabricator Qualifications:

1. Fabricator shall participate in the AISC Certification Program and shall be designated an AISC Certified Plant, Category STD at time of bid.


3. In lieu of AISC Certification, the fabricator must submit documentation or certification of approval per IBC, Section 1704.2.2.

4. SEPTA reserves the right to require NDE inspection from an independent testing agency, at no cost to SEPTA.

B. Design Requirements for Hand and Guardrails:

1. Railing assembly, wall rails, and attachments shall resist a concentrated load of 200 lbs applied at any point in any direction and a uniform load of 50 lbs per linear foot applied in any direction.

2. Guardrail assembly and attachments shall resist a concentrated load of 200 lbs applied at any point in any direction.
direction along the top railing member. Guardrail assembly shall also be designed to resist a uniform load of 50 lbs per square foot applied horizontally at the required guardrail height and a simultaneous uniform load of 100 lbs per square foot applied vertically downward at the top of the guardrail. The concentrated and uniform load shall not be applied simultaneously.

3. Where guard and handrails shall be installed in close proximity to overhead or third rail electrical services the assemblies shall be properly grounded and bonded by the electrical contractor. Note however, that the fabricator shall only be responsible for providing tabs, (2) per guard / handrail assembly, located at both ends of the bottom horizontal tube for the attachment of grounding cables. The responsibility for the installation of the hand and guardrails per the Electrical Drawings so that grounding and bonding will function as intended shall be the responsibility of the general contractor.

C. Field Visit and Measurements:

1. Prior to beginning the fabrication of the hand and guardrails for stairs and ramps, detailed field measurements must be taken.

2. When steel fabrication will be installed into an existing structure, or where the guard and handrail are configured different from the standard platform module layouts; "A," "B," "C," and "D," as shown on the standard guard/handrail drawings then field measurements for shop drawings shall be required prior to beginning fabrication.

3. Any discrepancies between the drawings and what is in the field shall be brought to the attention of the project manager. It is assumed that slight variation may exist and this is to be expected. Extras associated with discrepancies shall only be granted where these discrepancies can be proved to be a major consequence on the design and fabrication.

4. It is recommended that the fabricator visit the site prior to bidding on any fabrication in which the size of the project may require special on-site handling requirements, or where the fabrication must fit into existing conditions.
1.07 WARRANTIES

A. All components shall be warranted for 1 year against frame failure, mill scale, rusting, corrosion, rust stains, chipping, pealing, and/or paint discoloration and/or fading.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel square & rectangular shapes (HSS): ASTM A 500, grade B.
B. Steel section plates, shapes and bars: ASTM A 36.
C. Steel welded and seamless pipe: Schedule 40 and 80, ASTM A 120, A 53, and A 36.

2.02 FABRICATION

A. Fit and shop assemble components in sizes as shown on the drawings or the largest practical size when not shown on the drawings for shipping.
B. Fabricate components with joints tightly fitted, corners mitered and secured.
C. Supply components required for anchorage of fabrications. Fabricate anchors and related components from stainless steel and paint to match fabrication, except were specifically noted otherwise.
D. Exposed handrail fasteners shall be stainless steel, flush countersunk and with vandal resistant heads. Paint to match color of handrail.
E. Continuously seal joined pieces with continuous welds.
F. All welds shall be 1/4" fillet welds and ground smooth to eliminate sharp edges unless otherwise noted.
G. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush and hairline. Form exposed edges to tight uniform radius. Miter all corners. Inside corners must be ground smooth to create sharp right angles. All open ends must be closed-off.
H. Accurately form components, to each other and to building structure.

I. Galvanize all components after all welding has been completed, to the maximum extent possible. Provide holes throughout fabrication to permit galvanizing fluids to flow inside and out for complete galvanization. Drain holes in horizontal members shall be placed along the bottom of the tube. After the galvanization process close-up all holes not required to be weep holes. Holes shall be plugged with plastic or rubber, cut flush with metal surface prior to painting.

J. Fabrication Tolerances


2.03 GALVANIZING

A. Galvanizing process shall be suitable for paint finish work and shall meet ASTM A123 and ASTM D6386 standards.

1. Visible drips, splatters, and runs shall not be acceptable. The galvanizer shall provide a smooth consistent surface to receive paint.

B. Thickness

1. Provide 2.0 oz/sq ft (610 g/sw m) zinc coating

2. Galvanized assembly to receive a shop paint system shall not be quenched

C. Coordination

1. The galvanizer shall be responsible to assure that the material/fabrication does not warp, twist, or deform during the galvanizing process by providing adequate vent holes, controlling temperatures, and providing reinforcing. If the galvanizer has concerns that the material may deform during the galvanizing process he shall be responsible to bring this to the attention of the project manager. Going forward and galvanizing without notifying the project manager of potential problems shall be understood as confirmation that the galvanizer is comfortable with the material/fabrications’ size, thickness, and configuration.
2. The galvanizer shall coordinate the handling of the material/fabrication with both the fabricator and painting sub-contractors to assure that the product has been prepared properly and to the satisfaction of the next sub-contractor in line to receive and work on the material/fabrication for their respective portion of work.

2.04 PAINT SYSTEM

A. Surface Preparation

1. Brush Blast all galvanized steel prior to painting or

2. Prepare the surface with Hurrisafe S910 as manufactured by PCI of America, 800-222-1455 or approved equal.

3. DO NOT QUENCH galvanized steel, which shall receive paint finish.

B. Paint Systems or approved equal

1. The following Sherwin Williams paint systems, or approved equal, shall be used for all steel assemblies:
   (1) coat Corothane I - MIO Aluminum Primer B65S14
   (2) coats High Solids Polyurethane B65-300

   a. Dry Film Thickness:
      Prime - 2.0 to 3.0 mils DFT
      1st and 2nd coats - 3.0 to 4.0 mils DFT per coat
      Total system thickness = 8.0 to 11.0 mils DFT

2. When steel is welded after galvanization - Spot Prime Over Welded Areas and Finish
   (1) coat Corothane I - MIO Aluminum Primer B65S14
   (2) coats High Solids Polyurethane B65-300

   a. Dry Film Thickness:
      Prime - 2.0 to 3.0 mils DFT
      1st and 2nd coats - 3.0 to 4.0 mils DFT per coat
      Total system thickness = 8.0 to 11.0 mils DFT

3. Steel Assembly Base Plates
   (1) coat Corothane I - Galvapac Zinc Primer B65G11
   (1) coat Corothane I - MIO Aluminum Primer B65S14
   (2) coats High Solids Polyurethane B65-300

   a. Dry Film Thickness:
      1st Prime - 3.0 to 4.0 mils DFT
PART 3 EXECUTION

3.01 EXAMINATION AND INSPECTION

A. SEPTA reserves the right to shop inspect at any time during the fabrication and finishing process.

B. The contractor must notify SEPTA (5) days prior to beginning fabrication, galvanizing and painting, to determine if SEPTA shall require a shop inspection prior to allowing the product to move forward to the next phase.

3.02 INSTALLATION

A. The contractor shall supply all fasteners and attachments, which shall be, but not necessarily limited to, stainless steel threaded rods, washers, bolts, and nuts. Exposed fastener heads shall be painted to match the surrounding materials/assembly. Exposed fasteners shall be vandal resistant.

END OF SECTION
SECTION 05550
STAIR TREADS AND NOSING

PART 1 GENERAL

1.01 DESCRIPTION
A. Furnish all labor, materials, tools and equipment, and perform all operations necessary to install abrasive stair tread nosing, set in locations as indicated on the Contract Drawings and herein specified.

1.02 SUBMITTALS
A. Refer to Section 01300 Submittals

1.03 QUALITY CONTROL
A. Refer to Section 01401 – Quality Requirements

1.04 DELIVERY, STORAGE, AND HANDLING
A. Deliver materials in manufacturer’s original unopened packaging with product material designations marked thereon.
B. Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.
C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
D. Store materials and accessories off ground, under cover, and protected from weather and construction activities.

PART 2 PRODUCTS

2.01 MATERIALS
A. Provide 3" extruded Aluminum nosing base with abrasive filler, 3/8" thick for stair landings (Aluminum Alloy 535.2 ALMAG 35)

1. Approved manufacturers
   a. Wooster Products Inc., Type WP2C Spectra
   b. Westfield Sheet Metal Works, Inc.
   c. Safe-T-Metal Company, Inc., Aluminum
d. Or approved equal.

B. Abrasive shall be not less than 60% virgin grain Aluminum Oxide (AL203) abrasive, integrally cast into the walking surface flush.

C. Concealed type anchors shall be slotted rivet type, integrally cast into the body of the nosing a minimum of 3/8" (not mushroom type).

D. Extruded metals used shall be type 6063-T5 extruded aluminum.

PART 3  EXECUTION

3.01  INSTALLATION, GENERAL

A. Nosings shall be installed in accordance with the manufacturer’s instructions.

B. At the completion of the work, all damaged, improperly installed, and marred work shall be replaced or repaired to the satisfaction of the engineer/architect.

C. Nosings shall terminate not more than 3" from ends of steps for poured concrete stairs; for steel stairs, nosings shall be full length of steps less 1/8" (3.05 mm) clearance.

1. NOTE: Safety nosings to be installed in new poured concrete or cement fill shall be installed before "Initial Set" of the concrete or cement occurs.

END OF SECTION
PART 1

PART 2  GENERAL

2.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2.02 SUMMARY
   A. Section Includes:
      1. Decorative brackets
   B. Related Requirements:
      1. Section 09900 Painting

2.03 COORDINATION
   A. Coordinate installation of anchorages for decorative metal items. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

2.04 ACTION SUBMITTALS
   A. Product Data: For each type of product, including finishing materials.
   B. Shop Drawings: Show fabrication and installation details for decorative metal.
      1. Include plans, elevations, component details, and attachment details.
      2. Indicate materials and profiles of each decorative metal member, fittings, joinery, finishes, fasteners, anchorages, and accessory items.
   C. Samples for Initial Selection: For products involving selection of color, texture, or design.
      1. Full-size Sample or decorative brackets.
2. Samples of welded joints showing quality of workmanship and color matching of materials.

2.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator
B. Welding certificates.

2.06 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm experienced in producing decorative metal similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

B. Organic-Coating Applicator Qualifications: A firm experienced in successfully applying organic coatings, of type indicated, to extrusions and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

C. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Build mockups for the following types of decorative metal:
      a. Each type of decorative metal bracket

2.07 DELIVERY, STORAGE, AND HANDLING

A. Store decorative metal in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

B. Deliver and store cast-metal products in wooden crates surrounded by enough packing material to ensure that products are not cracked or otherwise damaged.

2.08 FIELD CONDITIONS
A. Field Measurements: Verify actual locations of walls and other construction contiguous with decorative metal by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 3 PRODUCTS

3.01 DECORATIVE METAL FABRICATORS

3.02 METALS, GENERAL

A. Metal Surfaces, General: Use materials with smooth, flat surfaces unless otherwise indicated. Use materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

3.03 STEEL AND IRON

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Tubing: ASTM A 500/A 500M (cold formed) or ASTM A 513, Type 5 (mandrel drawn).

C. Bars: Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

E. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M unless otherwise indicated.

F. Steel Sheet, Cold Rolled: ASTM A 1008/A 1008M, either commercial steel or structural steel, exposed.

3.04 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:

1. Stainless-Steel Items: Type 304 stainless-steel fasteners.

2. Uncoated-Steel Items: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating where concealed, Type 304 stainless-steel fasteners where exposed.


4. Dissimilar Metals: Type 316 stainless-steel fasteners.
B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless exposed fasteners are unavoidable.

1. Provide tamper-resistant machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193


3.05 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Lacquer for Copper Alloys: Clear, acrylic lacquer specially developed for coating copper-alloy products.

E. Shop Primers: Provide primers that comply with Section 09900 Painting

F. Intermediate Coats and Topcoats for Steel: Provide products that comply with Section 09900 Painting

G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

3.06 FABRICATION, GENERAL

A. Assemble items in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
B. Make up wire-rope assemblies in the shop to field-measured dimensions with fittings machine swaged. Minimize amount of turnbuckle take-up used for dimensional adjustment so maximum amount is available for tensioning wire ropes. Tag wire-rope assemblies and fittings to identify installation locations and orientations for coordinated installation.

C. Form decorative metal to required shapes and sizes, true to line and level with true curves and accurate angles and surfaces. Finish exposed surfaces to smooth, sharp, well-defined lines and arris.

D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

E. Form simple and compound curves in bars, pipe, tubing, and extruded shapes by bending members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces.

F. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

G. Mill joints to a tight, hairline fit. Cope or miter corner joints. Fabricate connections that will be exposed to weather in a manner to exclude water.

H. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.

I. Provide necessary rebates, lugs, and brackets to assemble units and to attach to other work. Cut, reinforce, drill, and tap as needed to receive finish hardware, screws, and similar items unless otherwise indicated.

J. Comply with AWS for recommended practices in shop welding. Weld behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded joints of flux, and dress exposed and contact surfaces.

1. Where welding cannot be concealed behind finished surfaces, finish joints to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 Welds: no evidence of a welded joint

3.07 DECORATIVE BRACKETS

A. General: Fabricate brackets to designs, shapes of sizes, and profiles indicated on drawings.
B. Welding: Interconnect brackets with full-length, full-penetration welds unless otherwise indicated. Use welding method that is appropriate for metal and finish indicated and that develops full strength of members joined. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

C. Brackets, Fittings, and Anchors: Provide fittings and anchors to connect rackets to other work unless otherwise indicated.

3.08 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

3.09 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize products made from rolled, pressed, and forged steel shapes, castings, plates, bars, and strips indicated to be galvanized to comply with ASTM A 123/A 123M.

1. Hot-dip galvanize steel and iron hardware indicated to be galvanized to comply with ASTM A 153/A 153M.

2. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

B. Preparing Galvanized Items for Shop Priming: After galvanizing, thoroughly clean decorative metal of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Primer Application: Apply shop primer to prepared surfaces of items unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

1. Shop prime uncoated ferrous-metal surfaces with primers specified in Section 09900 Painting

D. Shop-Painted Finish: Comply with Section 09900 Painting

1. Color: As indicated in finish schedule

PART 4 EXECUTION
4.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

4.02 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where needed to secure decorative metal to in-place construction.

B. Perform cutting, drilling, and fitting required to install decorative metal. Set products accurately in location, alignment, and elevation, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items to be built into concrete, masonry, or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, uniform reveals and spaces for sealants and joint fillers. Where cutting, welding, and grinding are required for proper shop fitting and jointing of decorative metal, restore finishes to eliminate evidence of such corrective work.

D. Do not cut or abrade finishes that cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing, or provide new units as required.

E. Install concealed gaskets, joint fillers, insulation, and flashings as work progresses.

F. Restore protective coverings that have been damaged during shipment or installation. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at same location.

   1. Retain protective coverings intact; remove coverings simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

G. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

4.03 INSTALLING DECORATIVE WINDOW SECURITY BARS
A. Fasten security bar frames to concrete and masonry walls with cast-in-place or post-installed anchors. Peen exposed threads of anchors to prevent removal of security bars.

4.04 INSTALLING DECORATIVE BRACKETS

A. Mount decorative brackets at heights and in positions indicated.
   1. Secure to canopy columns with specified fasteners.
   2. Fasten to concrete and masonry walls with post-installed anchors. Peen exposed threads of anchors to prevent removal.

4.05 CLEANING AND PROTECTION

A. Unless otherwise indicated, clean metals by washing thoroughly with clean water and soap, rinsing with clean water, and drying with soft cloths.

B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09900 Painting

D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

E. Protect finishes of decorative metal from damage during construction period with temporary protective coverings approved by decorative metal fabricator. Remove protective covering at time of Substantial Completion.

F. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION
SECTION 06100
ROUGH CARPENTRY

PART 1    GENERAL

1.01 DESCRIPTION
A. Provide rough carpentry work as shown and as specified per Contract Documents, including, but not limited to:
   1. Wood wall framing
   2. Wood grounds, blocking, and nailers
   3. Plywood mounting boards at electrical / mechanical rooms (fire retardant)
   4. Blocking for casework

1.02 RELATED SECTIONS
A. GENERAL:
   1. Refer to Section 01401 - quality requirements.
B. Section 07600 – Flashing and sheet metal
C. Section 07900 – Joint sealers

1.03 REFERENCES
B. Grading Rules:
   1. Douglas Fir, Hem-Fir, Idaho White Pine, and other Western Wood Products Association (WWPA) or West Coast Lumber Inspection Bureau (WCLIB).
   2. Southern Pine - Southern Pine Inspection Bureau (SPEB).
C. Preservative Treatment: American Wood Preservers' Association (AWPA) and American Wood Preservers Bureau (AWPB) standards.

1.04 QUALITY CONTROL
A. Fabricator’s Qualifications: All fabricators shall have experience in the successful completion of projects employing similar materials, applications, and performance requirements.

1.05 SUBMITTALS

A. Quality Control Submittals

1. Provide certification of treatment. Provide quality mark of accredited agency on each piece.

1.06 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY:

1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacturer’s unopened packages and bearing manufacturer’s label.

B. STORAGE AND HANDLING:

1. Store materials in a dry and well-ventilated place, adequately protected from damage and exposure to the elements.

2. Stack lumber, plywood, and other panels; place spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber:

1. Furnish seasoned dimensional lumber dressed to nominal sizes indicated with 19 percent maximum moisture content.

2. Concealed board lumber, less than 2” thick: Southern Pine No. 3 (SPIB), any species No. 4 (WWPA) or any species Standard (WCLM)

3. Miscellaneous Lumber - grounds, nailers, and blocking: standard grade, No. 3 grade, or better grade unless otherwise indicated; Douglas Fir, Hem-Fir, Idaho White Pine or Southern Pine.

B. Joists, Rafters, and Other Framing Not Listed Above: No. 1 grade.
1. Species:
   a. Douglas fir-larch; WCLIB or WWPA.

C. Exposed Framing: Provide material hand-selected for uniformity of appearance and freedom from characteristics, on exposed surfaces and edges, that would impair finish appearance, including decay, honeycomb, knot-holes, shake, splits, torn grain, and wane.

   1. Application: Exposed exterior framing indicated to receive a stained or natural finish.
   2. Retain first "Species and Grade" Subparagraph below or retain (or insert) one or more "Species and Grade" subparagraphs below.
   3. Species and Grade: As indicated above for load-bearing construction of same type.
   4. Species and Grade: Douglas fir-larch; No. 1 grade; WCLIB or WWPA.

2.02 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

   1. Blocking.
   2. Nailers.
   3. Furring.

B. For items of dimension lumber size, provide No. 2 grade lumber of the following species.

   1. Hem-fir; NLGA.
   2. Mixed southern pine; SPIB.
   3. Spruce-pine-fir; NLGA.
   4. Hem-fir; WCLIB or WWPA.
   5. Western woods; WCLIB or WWPA.
7. Northern species; NLGA.

8. Eastern softwoods; NeLMA.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.

2. Hem-fir or hem-fir (north); No. 2 Common grade; NLGA, WCLIB, or WWPA.

3. Spruce-pine-fir; No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.03 EXTERIOR PLYWOOD ROOF SHEATHING:

A. DOUGLAS FIR; APA, C-D GROUP I:

B. Span Rating: Not less than 16/0

C. Thickness: Not less than 5/8 inch

2.04 FASTENERS AND ANCHORING DEVICES:

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of hot dipped galvanized or stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

1. NES NER-272 covers power-driven staples, nails, P-nails, and allied fasteners.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

H. Preservative Treatment: Pressure-treat the following wood items, and other items indicated on the drawings, with waterborne preservatives complying with AWPB LP-2 (for above-ground use). Re-dry wood to a maximum moisture content of 19 percent after treatment.

I. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

J. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
   1. Blocking, cants, and similar members used in conjunction with roofing, copings, waterproofing and related flashing and trim.
   2. Blocking, furring, and similar concealed members in contact with exterior masonry and concrete (including interior wythe of exterior walls), and all sills for framing.

K. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC

L. Application: Treat items indicated on Drawings, and the following:
1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.05 METAL FRAMING ANCHORS

A. Manufacturer’s

1. Simpson Strong-tie Company, Inc.

2. Or approved Equal

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, which meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

1. Galvanized steel is typical for most manufacturers and is suitable for most applications.


1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

E. Stainless-Steel Sheet: ASTM A 666, Type 304.

1. Use for exterior locations and where indicated.

F. Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch wide nailing flanges at least 85 percent of joist depth.
1. Thickness: 0.062 inch.

G. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.
   1. Strap Width: 1 1/2 inch.
   2. Thickness: 0.062 inch.

H. Bridging: Rigid, V-section, nail less type, 0.050 inch thick, length to suit joist size and spacing.

I. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick.

J. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer’s written instructions.

D. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

   1. Use inorganic boron for items that are continuously protected from liquid water.

   2. Use copper naphthenate for items not continuously protected from liquid water.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

   1. NES NER-272 for power-driven fasteners.

   2. Table 2304.9.1, "Fastening Schedule," in NY State building Code.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

   1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

   2. Indicate locations of other fasteners, such as wood screws, bolts, and lag screws, on Drawings.

3.02 WOOD BLOCKING INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

D. Wood Nailers, Blocking, and Grounds:
   1. Provide items where required for attachment of other work.
   2. Size and space fasteners as required to support applied loading.
   3. Counter-sink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to form work before concrete placement. Shims shall be cedar shingles or redwood wedges.

E. Miscellaneous Rough Carpentry: Provide all wood blocking, attachment strips, rough framing and sheathing at coping coverings, canopy fascias, metal covered work, base flashing, railing sleeves and similar locations where indicated or required. Wood shall be preservative treated by pressure method as specified.

F. Plywood: Install with grain texture perpendicular to bearing members edges and ends occurring only over bearings.

G. Rough Hardware: Provide all rough hardware, such as nails, screws, anchors, bolts, buck anchors, clips, brackets, braces, fittings, and other rough hardware required for the proper fitting, connecting, and erecting of the work.

3.03 WOOD FURRING INSTALLATION

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Gypsum Board Install 1-by-2-inch nominal- (19-by-38-msize furring vertically at 16 inches o.c.

3.04 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions and for load-bearing partitions where framing members bearing on partition
are located directly over studs. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-6-inch nominal- 16 inches o.c. unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-4-inch nominal 16 inches o.c. unless otherwise indicated.
3. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
   1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.
   2. For load-bearing walls, provide double-jamb studs for openings 60 inches and less in width, and triple-jamb studs for wider openings. Provide headers of depth indicated.

3.05 FLOOR JOIST FRAMING INSTALLATION

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches of bearing on wood or metal, or 3 inches on masonry. Attach floor joists as follows:
   1. Where supported on wood members, by toe nailing or by using metal framing anchors.
   2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Fire Cuts: At joists built into masonry, bevel cut ends 3 inches and do not embed more than 4 inches

C. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches

D. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than 1/3 depth of joist; do not locate closer than 2 inches from top or bottom.

E. Provide solid blocking of 2-inch nominal thickness by depth of joist at ends of joists unless nailed to header or band.
F. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches or securely tie opposing members together. Provide solid blocking of 2-inch nominal thickness by depth of joist over supports.

G. Anchor members paralleling masonry with 1/4-by-1-1/4-inch metal strap anchors spaced not more than 96 inches o.c., extending over and fastening to three joists. Embed anchors at least 4 inches into grouted masonry with ends bent at right angles and extending 4 inches beyond bend.

H. Provide solid blocking between joists under jamb studs for openings.

I. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.
   1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

3.06 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes sufficiently wet that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION
THIS PAGE NOT USED
SECTION 06200
FINISH CARPENTRY

PART 1    GENERAL

1.01  DESCRIPTION

A. Provide interior architectural woodwork, as shown and specified per
   Contract Documents; including, but not limited to:

   1. Fascia and Soffits, Interior Benches, Interior Door & Window Trims
      and Sills, and wall wainscoting.

B. Related Sections

   1. Section 06100 – Rough Carpentry
   2. Section 07900 – Joint Sealers
   3. Section 09900 - Painting

1.02  SUBMITTALS

A. GENERAL: Refer to Contract Terms and Provisions, SUBMITTALS.

B. SHOP DRAWINGS: Submit manufacture and installation details,
   including fastenings, for review.

C. SAMPLES: For each type of product involving selection of colors,
   profiles, or textures.

D. PRODUCT DATA: Submit manufacturer’s specifications, data, and
   installation instructions for review.

E. CERTIFICATES: Submit AWI Certified Compliance Certificate, for
   fabricated woodwork, indicating grade as specified.

F. CLOSEOUT:

   1. Guarantee: Provide, in required form, for a period of one (1) year
      from date of final acceptance by Septa.

1.03  REFERENCES:

A. American Plywood Association (APA): Grading standards.

B. American Wood Preservers Association (AWPA): C2 - Wood Preservative
   Treatment by Pressure Process and C20 - Fire Retardant Treatment by
   Pressure Process.

1.04 QUALITY CONTROL

A. GENERAL: Refer to Section 01400 – QUALITY REQUIREMENTS
B. QUALIFICATIONS: Company specialized in the products specified in this Section with documented experience.
C. FABRICATOR’S QUALIFICATIONS: All fabricators shall have experience in the successful completion of projects employing similar materials, applications, and performance requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. PRODUCT HANDLING:
   1. Delivery: Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacturer’s unopened packages and bearing manufacturer’s label.
   2. Storage: Store materials in a dry and well-ventilated place, adequately protected from damage and exposure to the elements.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior finish carpentry materials until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
   1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 PRODUCTS

2.01 MATERIALS

A. LUMBER:
1. Grading: NBS PS-20 and applicable association rules under which each lumber species is produced.

2. Moisture Content: Per WIC standards; not greater than 19 percent maximum for lumber and 15 percent for plywood; air-dry or kiln-dry.

B. PLYWOOD: Douglas fir; APA, A-C Group 1 Exterior.

C. WOOD PRESERVATIVE TREATMENT:

D. ADHESIVE: CS 35-61, Type II, water-resistant.

E. FASTENERS:
   1. General: Of size and type to suit application; hot dipped galvanized at concealed locations; bright finish in exposed locations.

F. CAULKING COMPOUND: Per Section 07900 - JOINT SEALERS.

2.02 EXTERIOR SOFFIT:

A. Soffit
   1. 6" Tongue and Groove panel with plastic coated integral finish; 5/8" thick

B. Perimeter vent
   1. PS-400 strip vent; 1"x1 1/2"; match soffit color;
   2. Manufacturer:
      a. Cor-A-Vent, Inc/p.o. box 428/Mishawaka, IN 46546-0428/1-800-837-3868
      b. Or approved equal.

PART 3 EXECUTION

3.01 PREPARATION
A. ENVIRONMENTAL REQUIREMENTS: Do not install interior finish work until building is closed, temperature can be maintained above 50 degrees F and all plaster is dry.

B. EXAMINATION: Examine conditions of work in place before beginning work; report defects.

1. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

C. MEASUREMENTS: Take field measurements; report variance between plan and field dimensions.

D. PREPARATION

1. Clean substrates of projections and substances detrimental to application.

2. Before installing interior finish carpentry, condition materials to average prevailing humidity in installation areas for a minimum of 24 hours.

3.02 INSTALLATION

A. GENERAL: Install in conformance with referenced standards, manufacturer’s written directions, as shown, and as specified.

1. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, too small to fabricate with proper jointing arrangements, or with defective surfaces, sizes, or patterns.

2. Install interior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

a. Scribe and cut interior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.

b. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

c. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining interior finish carpentry with 1/32-
inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

3.03 MILLWORK:

A. General: Do not install millwork until wet operations are complete, with concrete and masonry work thoroughly dry, and millwork has been primed or sealed under Section 09900 - PAINTING. Reseal cut edges, surfaces, and ends as required.

B. Exterior:

1. Plywood: Install with grain texture perpendicular to bearing members edges and ends occurring only over bearings.

C. Interior:

1. General: Install plumb, square and true, securely wedged and anchored to structure. Countersink face nails and screws.

2. Plywood: Install with joints bearing on studs or solid backing. Slightly bevel adjoining panel edges by sanding before installation. Finish nail around perimeter and at studs; set nails and screws.

D. Trim Members:

1. General: Install level, plumb and true, with members neatly and accurately scribed in place. Install standing trim in single lengths, running trim in as long lengths as practical for species specified. Butt joints beveled together, exterior angles mitered, interior angles coped.

2. Exterior: Clear SPF, unless otherwise shown.

3. Interior: Clear pine, unless otherwise shown.

E. Fastening:

1. Exterior:

   a. Trim: 10d nails or 2 x 8 screws or less, use finish nails or flat head screws set 1/16 inch.

   b. Plywood: Screws long enough to penetrate structure per code requirements. Use galvanized screws, set flush without hammer marks.

2. Interior:

   a. Trim: Set nails or screws 1/16 inch, minimum; where clear finish is scheduled, fill with filler to match finish.
b. Plywood: Set nails or screws 1/16 inch, minimum.

F. Site Applied Wood Treatment: Apply preservative treatment in accordance with manufacturer’s instructions. Brush apply two (2) coats of preservative treatment on wood in contact with cementitious materials and roofing and related metal flashing. Treat site-sawn cuts. Allow preservative to dry prior to erecting members.

3.04 PANELING INSTALLATION

A. Plywood Paneling: Select and arrange panels on each wall to minimize noticeable variations in grain character and color between adjacent panels. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Install with uniform tight joints between panels.

1. Attach panels to supports with manufacturer’s recommended panel adhesive and fasteners. Space fasteners and adhesive as recommended by panel manufacturer.

2. Conceal fasteners to greatest practical extent.

3. Arrange panels with grooves and joints over supports. Fasten to supports with nails of type and at spacing recommended by panel manufacturer. Use fasteners with prefinished heads matching groove color.

B. Hardboard Paneling: Install according to manufacturer’s written recommendations. Leave 1/4-inch gap to be covered with trim at top, bottom, and openings. Butt adjacent panels with moderate contact. Use fasteners with prefinished heads matching paneling color.

1. Plaster or Gypsum-Board Substrate: Install with 1-5/8-inch annular-ring shank hardboard nails.

2. Nailing: Space nails 4 inches o.c. at panel perimeter and 8 inches o.c. at intermediate supports unless otherwise required by manufacturer.

C. Board Paneling: Install according to manufacturer’s written instructions. Arrange in random-width pattern suggested by manufacturer unless boards or planks are of uniform width.

1. Install in full lengths without end joints.

2. Install with uniform end joints with only end-matched (tongue-and-groove) joints within each field of paneling.

3. Select and arrange boards on each wall to minimize noticeable variations in grain character and color between adjacent boards. Install with uniform tight joints between boards.
4. Fasten paneling by face nailing, setting nails, and filling over nail heads.

3.05 CLEANING

A. GENERAL: Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris.

END OF SECTION
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SECTION 06602
FLAT PLASTIC DETECTABLE WARNING TILE

PART 1 GENERAL

1.01 DESCRIPTION

A. This section specifies the manufacture and installation of Plastic Detectable Warning Tile on Precast Concrete Platform panels that meets both the latest editions of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) and ANSI A117.1 codes.

B. The supplier shall provide a complete installation, including but not necessarily limited to Plastic Detectable Warning Tile, Adhesive, and Stainless Steel Fasteners including Plastic Fastener Caps.

C. Installed tactile shall be removable for future maintenance.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's literature describing products, installation, procedures, and routine maintenance.

B. Samples: Submit 12” x 12” minimum size samples of detectable warning surface tile, including anchorage component, of the kind proposed for use.

C. Material Test Reports: Submit test reports from qualified independent testing laboratory indicating that materials proposed for use are in compliance with all specification requirements and that both the coefficient of slip resistance and dome layout meets and or exceeds those recommended by both the latest editions of ADAAG and ANSI codes.

D. Shop Drawings: Submit standard Shop Drawings indicating installation method and layout.

1.03 REFERENCES

A. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

B. American National Standards Institute (ANSI)


C. ASTM International (ASTM):


1.04 QUALITY ASSURANCE AND CODE COMPLIANCE

A. Manufacturer: Provide adhesives and fasteners that are compatible and approved to be used with the Flat Plastic Detectable Warning Tile.

B. Warranty: The manufacturer shall warranty the material and the system for a period of ten (10) years from the date of substantial completion. This warranty shall cover the material and the system from failure including color fade, hazing, cracking, and fiber bloom.

C. Truncated dome size, profile, spacing, and layout shall match those specified in both the latest editions of ADAAG and ANSI A117.1 (Alignment: Truncated domes shall be aligned in a Square Grid Pattern).

D. Fasteners shall be 304 Stainless Steel and shall be tested to assure compliance. Vendor shall provide clear documentation confirming the grade of the stainless steel fasteners.

E. Fire Performance Testing and Approvals:

2. "Specific Optical Density of Smoke Generated by Solid Materials". The smoke density of tile adhered to 1/4" fiberglass reinforced cement board not to exceed specified values in compliance with the U.S. Department of Transportation Urban Mass Transportation Guidelines. These are less than 100 DS 1.5 and Less than 200 DS 4.0 when tested per ASTM D662.

3. "Toxic Gas Generation". Toxic gas generation of tile adhered to 1.4" fiberglass reinforced cement board not to exceed the following Specified values in compliance with the U.S. Department of Transportation Urban Mass Transportation.

4. Guidelines: Boeing BSS 7239 -Requirements: Products of combustion are to be less than the Specified maximum for CO, HCN, HCl, HF, HBr, SO, NO

5. "Critical Radiant Flux of Floor Covering System Using a Radiant Heat Energy Source". Critical radiant flux of tile adhered to 1/4" fiberglass reinforced cement board not to be less than the following Specified value: ASTM E648 - Requirement:

6. >1.10 w/cm²

7. Detectable warning surface tile shall meet or exceed the following test criteria:

   a. Dimensions of tile to be held within the following dimensions and tolerance: Length and width: 48.000" x 24.000"+/-0.6% max.

   b. Thickness: 0.375" +/-5% max.

   c. Edge Warp: +/-0.5% max.

   d. Water Absorption, ASTM D570: 0.07% max.

   e. Slip Resistance, 0.80 min.

   f. Compressive strength, ASTM D695: 28,000 psi min.

   g. Tensile Strength, ASTM D638: 11,000 psi min.
1.05 DELIVERY, STORAGE, AND HANDLING

A. Detectable warning surface tiles shall be delivered installed onto platform panels.

1.06 JOB CONDITIONS

A. Environmental conditions and protection: Maintain the ambient temperature at 40° F or above during installation and curing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Vitrified Polymer Composite (VPC) Surface Applied Detectable/Tactile Warning as manufactured by;

1. Armor-Tile, 300 International Drive, Suite 100, Williamsville, NY 14221-5783, telephone (800-682-2525).

2. ADA Solutions, Inc., P.O. Box 3, North Billerica, MA 01862-0003, telephone (800-372-0519)

3. Or approved equal.

B. Size:

1. VPC tiles shall be nominally 48" x 24" with a thickness not less than 3/8" or greater than 1/2". Color shall be "Safety Yellow" conforming to Federal Color No. 33538. Color shall be homogeneous throughout the tile.

C. Dome Spacing:

1. Size – Truncated domes shall have a base diameter of 0.9 inch minimum to 1.4 inch maximum to 65 percent maximum of the base diameter.
2. Height – Truncated domes shall have a height of 0.2 inch.

3. Spacing – Truncated domes shall have a center to center spacing of 1.6 inches minimum and 2.4 inches maximum, and a base-to-base spacing of 0.65 inch minimum, measured between the most adjacent domes on the grid.

4. Alignment – Truncated domes shall be aligned in a square grid pattern.

D. Profile:

1. Detectable Warning Tile shall be flat and without flanges or sloped beveled edges (45 degree slope at edge is acceptable as long as slope distance is not greater than \( \frac{1}{4}\)”). Kerf cuts shall not be required. When panel is laid flat, warping shall not be evident.

E. Setting, Grouting, and Mechanical Fastener Materials:

1. Heavy duty white elastomeric polyurethane adhesive "ULTRA SET" as manufactured by Mapei, Bostik, or ADA ChemLink M1 Adhesive or approved equal.

2. Joint Sealant shall be BASF NP1 or Sikaflex 1A or approved equal.

3. Stainless Steel Pin Bang Rivets, 1/4-inch x 1 1/2-inches, to be positioned in the molded recess of a minimum fifteen (15) truncated domes per tile positioned at both the perimeter and interior of each tile.

   a. Type: 304 Stainless steel.

4. Vitrified Polymer Composite (VPC) truncated dome caps to be press fit and bonded into fifteen (15) corresponding truncated domes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Pre-Cast Concrete Panel Installation:

1. Flat Plastic Detectable Warning Tiles for all pre-cast platform panels and low-level platform edge elements shall be supplied and installed by the Pre-Cast provider prior to shipping to the project site.
2. Tile installation shall be per approved tile manufacturer requirements. Coordinate manufacturer and model number with General Contractor.

B. Cast-In-Place Concrete Panel Installation:

1. Flat Plastic Detectable Warning Tiles for all cast-in-place platform panels shall be supplied and installed by the General Contractor in the field.

2. Tile installation shall be per approved tile manufacturer requirements.

3. It is the General Contractor’s responsibility to coordinate Flat Plastic Detectable Warning Tile manufacturer and model number with the Pre-Cast provider to ensure consistency throughout the high-level platform, low level platform, and temporary walkway.

END OF SECTION
SECTION 06650
PLATFORM RUBBING EDGE

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this specification consists of the fabrication and delivery of polyethylene platform rubbing edge sections.

B. The Contractor shall be responsible for all materials, labor and transportation required for delivery of complete assemblies to a location designated elsewhere in the Contract Documents.

1.02 QUALITY REQUIREMENTS

A. The platform edge strips shall be constructed as indicated on the drawings. All work shall be plumb and true and in conformance with the details or other pertaining information shown on the drawings or specified herein. All materials shall be transported, stored, handled and installed in conformance with the manufacturer's recommendations and instructions.

1.03 REFERENCES

A. Provide (1) 8”x8 ½”x3” sample of the material with a pre-drilled hole as shown on the drawings.

B. Provide (1) set of shop drawings detailing the strips, i.e. lengths, hole locations and sizes, etc. Include material schedule. American Welding Society (AWS):

C. Provide (1) copy of product information for polyethylene strips.

D. Submit manufacturer’s standard warranty.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Engineered Plastics, Inc./ 300 International Drive/ Williamsville, NY 14221/ 800-682-2525

B. ADA Solutions, Inc./PO Box 3/ N. Billerica, MA 01862/ 800-372-0519

C. Or approved equal.
2.02 POLYETHYLENE PLATFORM EDGE STRIP

A. All shapes, lengths, and holes shall be as indicated on the drawings.
B. Material: Ultra-high Molecular Weight Polyethylene
C. Color: Safety Yellow; Color shall be integral throughout.
D. The coefficient of thermal expansion in degrees Fahrenheit, tested in accordance to ASTM D696, shall not be greater than:
   1. 0° to 75°: 1.1x10-4n inches per inch
   2. 75° to 120°: 1.87x10-4n inches per inch

2.03 FABRICATION

A. The top surface of the edge strips shall be roughened by scarification to create a non-slip surface
   1. The static coefficient of friction of the top surface shall be no less than 0.6.
B. Tolerances
   1. The straightness tolerance on the platform edge side of the rubbing board shall be 1/8" in a 16'
   2. The variation in width of the board shall not be more than 1/16" in any length section.

PART 3 EXECUTION

3.01 PACKING AND SHIPPING

A. All items shall be shipped at one time as complete packages.
B. All components shall be packaged and shipped so as to protect the integrity and finish from any damage whatsoever.
C. The Contractor shall contact SEPTA at least 48 hours prior to delivery.

3.02 INSTALLATION

A. Installation shall be by SEPTA work forces.

END OF SECTION
PART 1    GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing on perimeter foundation walls.
B. Seal/caulk joints and protrusions through dampproofing.

1.02 SYSTEM DESCRIPTION

A. Dampproofing (DAMP) assembly consists of dampproofing, polyethylene sheeting, and either protection board or rigid insulation as indicated. ASTM C 109; Test Method for Compressive Strength of Hydraulic Cement Mortars (Using two-inch or 50-mm Cube Specimens).

1.03 SUBMITTALS

A. Product Data: Manufacturer's specifications and technical data including the following:

1. Detailed specification of construction and fabrication.
2. Certified test reports indicating compliance with performance requirements specified herein, including VOC compliance and certification that products do not contain asbestos material.

1.04 QUALITY CONTROL:

A. Installer Qualifications: An experienced installer who has specialized in installing bituminous dampproofing similar in material, design, and extent to those indicated for this project and whose work has resulted in installations with a record of successful in-service performance.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacturer's unopened packages and bearing manufacturer's label.

B. Storage:
1. **General:** Store materials in a dry and properly ventilated separate structure not less than 50'=0" from any other structure on the site. Adequately protect from damage and exposure to the elements.

2. **Temperature:** Maintain minimum of 45 degrees F and a maximum of 90 degrees F.

3. **Fire Prevention:** Take necessary precautions to prevent fire; remove soiled rags and waste from building each day or store in metal containers with covers in the storage structure.

### 1.06 PROJECT CONDITIONS

A. **Substrate:** Proceed with dampproofing work only after substrate construction and penetrating work have been completed.

B. **Weather:** Proceed with dampproofing work only when existing and forecasted weather conditions will permit work to be performed in accordance with manufacturer's recommendations.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

A. **Acceptable Manufacturers for Dampproofing:**


2. Grace Construction Products.


5. Euclid Chemical Company: Euco Foundation Coating.


7. Or approved equal

#### 2.02 MATERIALS

A. **(DAMP-1) Bituminous Dampproofing for Below Grade Applications:** Fiber reinforced (non-asbestos), solvent-base, non-sag asphaltic coating designed for troweled application and conforming to following:

1. ASTM D4586, Type 1.
2. Acceptable manufacturers and product:
   a. Sonneborn Building Products: Mastic.
   b. Meadows Incorporated: Sealmastic Solvent Type Trowel Mastic.
   c. Karnak Corporation: Karnak 86 AF Fibrated Trowel Mastic.
   d. Horn Incorporated: Dehydratine #6.
   e. Or approved equal

2.03 ACCESSORIES
   A. Neoprene Flashing: 60 mil uncured neoprene compatible with bituminous dampproofing.
      1. Size: 6 inches wide (typical) by continuous length.
   B. Flashing Adhesive: As recommended by neoprene flashing manufacturer.

PART 3 EXECUTION

3.01 SURFACE PREPARATION
   A. Ensure surfaces are firm, dry and free from frost, loose particles, cracks, pits, rough projections, grease, oil and other foreign matter detrimental to adhesion and monolithic application of dampproofing.
   B. Remove loose particles and foreign matter with scraper, wire brush or other means. Remove grease or oil with safety solvent, effective alkaline cleaner or detergent. If safety solvents are used, follow with application of alkaline cleaner or detergent, scrub surfaces clean with water.

3.02 APPLICATION ON BELOW GRADE SURFACES
   A. Provide bituminous dampproofing where indicated and on exterior side of below grade walls where interior floor slab is below exterior grade.
   B. Expansion and Control Joints in Below Grade Walls:
      1. Install joints before application of dampproofing.
      2. Prime substrate that is to receive flashing adhesive as recommended by adhesive manufacturer.
      3. Install continuous strip of neoprene flashing centered over joint. Roll into adhesive to ensure bond.
a. Ensure that center portion of neoprene flashing over joint (one inch from each side of joint center line) is not bonded. Do not stretch flashing over joint.

b. Trowel flashing adhesive continuously along each edge of neoprene flashing to provide watertight seal.

4. Terminate under horizontal waterproofing above.

C. Trowel apply one coat of dampproofing to obtain film thickness of not less than 1/8 inch.

D. Extend dampproofing from 6 inches below finish grade to vertical face of footing. Carry dampproofing over top of footings, forming cove at junction of wall and footing.

E. Install rigid perimeter insulation specified under Section 07210 as indicated. Hold in place with insulation adhesive.

F. Coordinate installation with backfilling Work.

3.03 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION
PART 1    GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and
      Supplementary Conditions and Division 01 Specification Sections, apply to
      this Section.

1.02 SUMMARY
   A. Section Includes:
      1. Extruded polystyrene foam-plastic board.
      2. Glass-fiber blanket.
   B. Related Requirements:
      1. Section 03300 – Cast-in-place concrete
      2. Section 07160 - Bituminous Dampproofing

1.03 ACTION SUBMITTALS
   A. Product Data: For each type of product.

1.04 INFORMATIONAL SUBMITTALS
   A. Product Test Reports: For each product, for tests performed by a qualified
      testing agency.
   B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.05 DELIVERY, STORAGE, AND HANDLING
   A. Protect insulation materials from physical damage and from deterioration
      due to moisture, soiling, and other sources. Store inside and in a dry
      location. Comply with manufacturer's written instructions for handling,
      storing, and protecting during installation.
   B. Protect foam-plastic board insulation as follows:
      1. Do not expose to sunlight except to necessary extent for period of
         installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 PRODUCTS

2.01 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

B. Extruded Polystyrene Board, Type IV (Foundation walls): ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Owen Corning
2. Dow Chemical Company
3. Diversifoam products
4. Or approved Equal

2.02 GLASS-FIBER BLANKET

A. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:

1. Free of Formaldehyde: Insulation manufactured with 100 percent acrylic binders and no formaldehyde.

2. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

B. Glass-Fiber Blanket, Kraft Faced ASTM C 665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).

1. Owens Corning
2. Johns Manville
3. Certainteed
4. Or approved equal

2.03 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

1. Manufacturer
   a. Gemco
   b. AGM Industries
   c. Or approved Equal

2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.

3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.

B. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

1. Manufacturer
   a. Gemco
   b. AGM Industries
   c. Or approved Equal

2.04 ACCESSORIES

A. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 EXECUTION

3.01 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.
3.02 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.03 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Adhesive Installation: Install with adhesive or press into tacky waterproofing or damp proofing according to manufacturer's written instructions.

3.04 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.

2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.

3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.

4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets.

5. For wood-framed construction, install blankets according to ASTM C 1320 and as follows:
a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.

6. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

   a. Exterior Walls: Set units with facing placed toward interior of construction.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.

   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.05 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION
SECTION 07260

REINFORCED VAPOR RETARDERS FOR UNDER SLABS

PART 1    GENERAL

1.01 SECTION INCLUDES
A. Reinforced vapor retarders for under concrete slab applications.

1.02 RELATED SECTIONS
A.  
B. Cast-in-Place Concrete: Section 03300

1.03 REFERENCES
A. American Society for Testing and Materials:
   1. ASTM D 882 - Tensile Properties of Thin Plastic Sheeting.
   2. ASTM D 1709 - Impact Resistance of Plastic Film by the Free-Falling Dart Method.
   3. ASTM D 2582 - Puncture-Propagation Tear Resistance of Plastic Film and Thin Sheeting.
   4. ASTM D 3776 - Mass per Unit Area (Weight) of Woven Fabric.
   5. ASTM D 4833 - Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
   7. ASTM E 1643 - Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
   8. ASTM E 1745 - Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.04 SUBMITTALS
A. Comply with Section 01300 – Submittals.
B. Product Data: Submit manufacturer's product data, including installation instructions.

Reinforced Vapor Retarders For Under Slabs 07260-1
C. Samples: Submit manufacturer’s samples of reinforced vapor retarders.

QUALITY REQUIREMENTS

1.05 QUALITY ASSURANCE

A. Preinstallation Meeting: Hold a preinstallation meeting 2 weeks before start of installation of reinforced vapor retarders. Require attendance of parties directly affecting work of this section, including Contractor, Architect, and installer. Review installation, protection, and coordination with other work.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Handling: Protect materials during handling and installation to prevent damage.

PART 2 PRODUCTS

2.01 MANUFACTURER


B. Or approved equal

2.02 REINFORCED VAPOR RETARDERS FOR UNDER CONCRETE SLABS

A. Reinforced Vapor Retarder:

   2. Material: 3-ply laminate, combining 2 layers of high-density polyethylene and 1 high-strength non-woven cord grid.

   3. Weight, ASTM D 3776: 37 lb/1,000 ft² (18.1 kg/100 m²).


   5. Permeance (Perm), ASTM E 96: 0.038 grains/hr-ft²-in Hg (2.18 ng/(Pa-s-m²)).
6. Drop Dart, ASTM D 1709 Method B: 500 g.

7. Tensile Strength, 3 Inches, ASTM D 882: 96 lb/5,442 psi (427 N/37,522 kPa).


9. Classification, ASTM E 1745: Class C.

10. Usable Temperature Range: -25 to 170 degrees F (-32 to 77 degrees C).

2.03 ACCESSORIES

A. General: Ensure accessories are from same manufacturer as reinforced vapor retarders.

B. Mastic Tape: Griffolyn Fab Tape.
   1. Description: Black, double-sided, asphaltic, pressure-sensitive, mastic tape.
   2. Weight: 3.75 pounds per 100 feet.
   3. Thickness: 35 mils.
   4. 3 Inch Seam Shear: 35 pounds.

C. Self-Adhesive Repair Tape: Griffolyn Griff-Tape.

D. Pipe Boots: Griffolyn pipe boots, factory-fabricated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive reinforced vapor retarders. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install reinforced vapor retarders in accordance with ASTM E 1643 and manufacturer’s instructions.

B. Install vapor retarders continuously at locations under slab as indicated on the drawings. Ensure there are no discontinuities in vapor retarder at seams and penetrations.

C. Install vapor retarders in largest practical widths.
D. Ensure subgrade beneath vapor retarder is smooth, level, and compacted with no sharp projections.

E. Join sections of vapor retarder and seal penetrations in vapor retarder with mastic tape. Ensure vapor retarder surfaces to receive mastic tape are clean and dry.

F. Ensure there is no moisture entrapment by vapor retarder due to rainfall or ground water intrusion.

G. Immediately repair holes in vapor retarder with self-adhesive repair tape.

H. Seal around pipes and other penetrations in vapor retarder with pipe boots in accordance with manufacturer's instructions.

3.03 PROTECTION

A. Protect reinforced vapor retarders from damage during installation of reinforcing steel and utilities and during placement of concrete slab or granular materials.

B. Immediately repair damaged vapor retarder in accordance with manufacturer's instructions.

END OF SECTION
SECTION 07270
AIR BARRIER

PART 1 GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. Section Includes:
   1. Building wrap.
   2. Flexible flashing.
B. Related Requirements:
   1. Section 13121 - Pre-Fabricated Station Building & Canopy

1.03 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

PART 2 PRODUCTS

2.01 WATER-RESISTIVE BARRIER
A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
   1. Dupont Building Innovations, Tyvek
   2. Pactive Corporation, Green Guard
   3. Dow Chemical Company
   4. Or approved equal
B. Water-Vapor Permeance: Not less than 20 perms per ASTM E 96/E 96M, Desiccant Method (Procedure A).

1. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.

2. Allowable UV Exposure Time: Not less than three months.

C. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

PART 3 EXECUTION

3.01 WATER-RESISTIVE BARRIER INSTALLATION

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistive barrier as follows:

1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.

2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

C. Building Wrap: Comply with manufacturer's written instructions.

1. Seal seams, edges, fasteners, and penetrations with tape.

2. Extend into jambs of openings and seal corners with tape.

END OF SECTION
SECTION 07410
METAL ROOF AND WALL PANELS

PART 1    GENERAL

1.01 DESCRIPTION
A. The work of this section shall include but not be limited to supplying and installing the following Roof System:
   1. Factory formed aluminum roof panels: Standing-seam, hidden fastener, non-insulated
   2. Associated Aluminum Flashing
   3. Aluminum Gutter and Rainwater Leaders
   4. Snow Guard system

1.02 RELATED WORK
A. Section 01300 – Submittals
B. Section 01400 – Quality Requirements
C. Section 01700 – Contract Closeout
D. Section 06100 – Rough Carpentry
E. Section 07620 – Sheet metal flashing and trim
F. Section 13121 – Pre-Fabricated Station Building

1.03 REFERENCES
A. The Aluminum Association, Inc. – Specifications for Aluminum Structures
B. Architectural Sheet Metal Manual – SMACNA
C. American Society for Testing Materials – ASTM
   1. ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   2. ASTM A 666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
3. ASTM A 792 Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy Coated by the Hot-Dip Process

4. ASTM B 209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate

5. ASTM E 283 Standard Specification for Testing Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Pressure Differences Across the Specimen


8. ASTM E 1680 Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems

D. American Iron and Steel Institute – AISI

1. Specifications for the Design of Cold-Formed Steel Structural Members

E. American Society of Civil Engineers – ASCE

1. ASCE-7, Minimum Design Loads for Buildings and Other Structures
2. ASCE-8, Specification for the Design of Cold-Formed Stainless Steel Structural Members


G. FM Approved Standards, FM Global

1. FM Approved Standard 4471 for Class 1 Panel Roofs

H. UL Standards for Safety, Underwriters Laboratories, Inc.

1. UL 263 Standard for Safety for Fire Tests of Building Construction and Materials
2. UL 580 Tests for Uplift Resistance of Roof Assemblies
3. UL Fire Resistance Directory
4. UL Roofing Materials Directory
I. Steel shall be Commercial Grade Base Material conforming to ASTM A 653

J. Galvanized Steel shall meet ASTM A 525 G-90 (1.25oz.)

1.04 QUALITY ASSURANCE

A. Maintain (1) copy of manufacturer’s installation instructions on project site.

B. Verify that manufacturer’s label contains reference to specified standards.

C. Performance Test Standards: Provide preformed roof panel system, which have been pre-tested and certified by manufacturer to meet or exceed UL 580 (UL 90) wind-up lift specifications.

   1. Provide calculations or documentation that show clip spacing, fastener sizes and numbers that back up wind-up lift requirement as stated above. Calculations shall be for field, edge and corner conditions.

D. All layout and designs shall conform to current building codes (IBC).

E. All panels shall be factory formed and packaged per job requirements.

F. Provide protective film on both sides of roof panels for protection during shipping.

1.05 DESIGN REQUIREMENTS

A. Design Loads

   1. Design loads and load combinations will be in accordance with ASCE 7 and IBC General: Provide metal roof panel assemblies that comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

   2. Dead loads shall be the weight of the roof system

   3. Live Loads:

      a. Concentrated Loads: The panels and anchor clips shall be capable of supporting a 300 pound concentrated load. The concentrated load shall be applied at the panel mid-span and will be resisted by a single standing seam metal roof panel assumed to be acting as a beam. The un-deformed shape of the panel shall be used to determine the section properties

      b. Uniform Loads: The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 30 psf.
4. Roof Snow Loads including unbalanced roof snow loads and drift load will be calculated in accordance with ASCE 7. The ground snow load for design is 30 psf. Down-slope forces should be considered for all roof slopes and for all roofing systems. Of particular concern are the roofs that have snow guards attached to the panel system since they have the potential for greatly increasing the down-slope forces.

5. Wind Loads:
   a. The internal pressure coefficient for buildings shall be in accordance with ASCE 7. The internal pressures also apply to roof systems above substrates since the panels do not lie directly on the substrate. Wind-Uplift Resistance: Capable of resisting design negative uplift pressures based upon maximum wind speeds. Provide clips, fasteners, and clip spacing of type indicated and with capability to sustain, without failure, a load equal to 2 times the design negative uplift pressure.
   b. Wind-Uplift Resistance: Capable of producing sheet metal roofing assemblies that comply with UL 580 for Class 90 wind-uplift resistance.
   c. The design wind speed is 100 mph.
   d. The wind load pressure for the roof system shall not be less than 30 psf. The wind pressure shall be determined for all zones including edges, eaves, ridges, overhangs, and corners.
   e. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the considered when figuring faster design loads.

   B. Single fastener in each connection – 3.00
   C. Two or more fasteners in each connection – 2.25

1.06 SUBMITTALS

A. Submit under provisions of Section 01300 – Submittals
B. Manufacturer’s Installation Instructions: Provide published instructions that indicate preparation and installation procedures.
C. Product Data: Submit manufacturer's product specifications, standard details, certified product test results, installation instructions, and general
recommendations, as applicable to materials and finishes for each component and for total system of preformed panels.

D. Samples: Submit two (2) 12" square samples of: roof panels, clips, ridge vent, eave flashing, and panel closure caps.

E. Shop Drawings: Submit small-scale (1/8"=1'-0" minimum) layouts of roof panels, and large-scale (1 1/2"=1'-0" minimum) details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory and field assembly work. Key these drawings to the delivered materials, clearly labeling these materials to indicate placement.

F. Furnish 20-year warranty on performance of exterior metal finish. Provide 30-year warranty on panel finish.

G. The contractor shall be responsible for providing SEPTA’s engineer/architect with shop drawings, catalog cuts, and design calculations for approval. All plans and calculations must be stamped and signed by an engineer currently licensed in the Commonwealth of Pennsylvania. No work shall begin prior to receiving all approvals.

H. Product test reports. Based on evaluation of comprehensive tests performed by a qualified testing agency, for the following:


2. Insulation and Vapor Retarders: Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Installer of sheet metal roofing approved & trained by roofing manufacturer with documented history of installation of (5) five projects of similar complexity.

B. Roll-Formed Sheet Metal Roofing Fabricator Qualifications: Minimum of 10 years factory forming experience.

C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

D. Source Limitations: Obtain each type of metal roof panels through one source from a single manufacturer.

F. Fire-Resistance Ratings: Where indicated, provide metal roof panels identical to those of assemblies tested for fire resistance that comply with ASTM E 108 in accordance with UL790.

G. Pre-installation Conference: Conduct conference at project location with building owner, architect, installing contractor, general contractor and sheet metal roofing manufacturer a minimum of 10 days prior to start of work. All details shall be reviewed including; underlayments, substrates, fastening patterns, scheduling, trim and flashing components, accessories such as fasteners and sealants.

H. Construction Inspection: Manufacturer shall conduct on site inspection and formal written report to architect and owner at the following intervals: 50 percent sheet metal roofing installation completion, and final inspection upon completion of roof system. Related to warranty - standard level.

1.08 DESIGN INTENT

A. The roof system shall be assembled to the largest extent possible in the factory to minimize site installation time.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver materials of this section to project site until suitable facilities for storage and protection are available.

B. Protect materials from damage during transit and at project site. Store under cover, but sloped to provide positive drainage. Do not expose materials with strippable protective film to direct sunlight or extreme heat.

C. Do not allow storage of other materials or allow staging of other work on installed metal panel system.

D. Upon receipt of delivery of metal panel system, and prior to signing the delivery ticket, the installer is to examine each shipment for damage and for completion of the consignment.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal roof panels to be performed according to manufacturers’ written instructions and warranty requirements.
B. Field Measurements: Verify locations of roof framing and roof opening dimensions by field measurements before metal roof panel fabrication and indicate measurements on Shop Drawings.

1.11 SCHEDULING

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are specified in Division 7 Section "Roof Accessories."

B. Coordinate metal panel roof assemblies with rain drainage work, flashing, trim, and construction of decks, purlins and rafters, parapets, walls, and other adjoining work to provide a leakproof, secure, and non-corrosive installation.

1.12 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish Warranty Period: 30 years from date of Substantial Completion.

B. Special Installer's Warranty: Specified form in which Roofing Installer agrees to repair or replace components of custom-fabricated sheet metal roofing that fail in materials or workmanship within 5 years from date of Substantial Completion.

C. Special Weathertight Warranty: Manufacturer's Standard warranty in which manufacturer agrees to repair or replace roof panel assemblies that fail to remain weathertight within the specified warranty period.

1. Product Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. In order to establish a standard of quality, subject to compliance with requirements, provide preformed roofing products by the following, or approved equal.

1. Aluminum Roofing: ATAS MRB 160 structural standing seam metal roof system as manufactured by ATAS, 6612 Snowdrift Road Allentown, PA 18106 / 610.395.8445 / 800.468.1441
2. **Snow Guard system**: S-5! Attachment Solutions Metal Roof Innovations, LTD./ 8655 Table Butte Road/ Colorado Springs, CO 80908/ 888-825-3432 or approved equal.

### 2.02 BATTEN-SEAM ROOF PANELS

**A. General**:
Provide factory-formed metal roof panel assembly designed to be field assembled by covering vertical side edges of adjacent panels with battens and mechanically attaching panels to supports using concealed clips. Include accessories required for weathertight installation.

**B. Integral-Batten-Seam Metal Roof Panels**: Formed with integral ribs at panel edges and flat pan between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and lapping and interconnecting side edges of adjacent panels.

1. **Basis-of-Design Product**: ATAS International, Inc.; Monarch™ Batten Seam; MRB160 or approved equal.

2. **Manufacturer**:
   a. ATAS International, Inc.

3. **Material**: Aluminum .040
   a. Texture: Smooth
   b. Pan Coverage: 16"
   c. Seam Height: 2" Batten
d. KYNAR 5000® PDVF or HYLAR 5000® Finish
e. Patina Green (12)

### 2.03 FINISHES

**A. Paint Finishes**: Coating systems shall have been tested in accordance with ASTM standard test methods for factory color finish. Exterior color shall be Antique Patina.

1. **Polyvinylidene Fluoride (PVDF)**: Two-coat system consisting of a nominal 0.2 mil corrosion inhibitive primer on both sides with a 0.75 mil fluoropolymer exterior topcoat and 0.30 mil backer finish.

### 2.04 MISCELLANEOUS MATERIAL
A. Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads. Manufacturer shall provide or authorize all fasteners utilized with the sheet metal roofing system.

1. Exposed Fasteners: Heads matching color of sheet metal roofing by means of plastic caps or factory-applied coating.

2. Fasteners for Flashing and Trim: Blind fasteners or screws spaced to resist wind uplift loads.

B. Sealing Tape: Pressure-sensitive, 100 percent solid polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape.

C. Elastomeric Joint Sealant: ASTM C 920, of base polymer, type, grade, class, and use classifications required to produce joints in sheet metal roofing that will remain weathertight.

D. Expansion-Joint Sealant: For hooked-type expansion joints, which must be free to move, provide non-setting, non-hardening, non-migrating, heavy-bodied polyisobutylene sealant.

E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat.

2.05 ACCESSORIES

A. Sheet Metal Roofing Accessories: Provide components required for a complete sheet metal roofing assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of sheet metal roofing, unless otherwise indicated. All trim and flashing components shall be supplied in a minimum of 12’-0” lengths and shall conform to manufacturer's standard part dimensions and details.

1. Structural - 18 ga. SS Expansion clips designed to withstand negative-load requirements.

2. Closures: Closed-cell, expanded, cellular, rubber or cross linked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match sheet metal roofing profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

3. Sealants as recommended by manufacturer.

4. Fasteners as recommended by manufacturer.
B. Flashing and Trim: Formed from matching materials as sheet metal roof panel in gauges noted. Provide flashing and trim in heavier gauge materials as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent sheet metal roofing.

C. Gutter: 6”x6” Box Gutter with Stiffeners.

1. Thickness: 0.040”

2. Finish: Sherwin Williams SW 6468 Hunt Club, or approved equal

D. Gutter Drip Edge: Drip Edge must extend from deck down to gutter.

1. Thickness: 0.040” minimum

2. Finish: To match roofing panels

E. Rain Water Leader:

1. 3”x4” aluminum

2. Thickness: 0.040” minimum

3. Finish: Sherwin Williams SW 6468 Hunt Club, or approved equal

F. Snow Guard System

1. Continuous Color Gard Snow Retention System by Metal Roof Innovations, Ltd.; fastened to roof seams around entire roof perimeter as recommended by manufacturer with S-5! SnoClips, (2) per pan width Or Approved Equal

G. Finish: to match roofing panels Vented Ridge Cap
1. ATAS or Approved Equal.

2. Material & Finish: Match Roofing

3. Height: 3.5”

4. Description: Vented Ridge Cap

5. Provide external baffle and insect screen on Vented Ridge Cap.

2.06 EQUIPMENT

A. Manufacturer must maintain quality control and maintenance procedures of all equipment. Verification of quality control procedures must be validated by a 3rd party entity.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ATAS International, Inc.

2.07 FABRICATION

A. General: Fabricate sheet metal roofing and components to comply with details shown, manufacturers installation details and recommendations in SMACNA's "Architectural Sheet Metal Manual" and NRCA Waterproofing Manual that apply to the design, dimensions (pan width and seam height), geometry, metal thickness, and other characteristics of installation indicated. Fabricate sheet metal roofing and accessories at the manufacturer’s location to the greatest extent possible.

B. General: Fabricate sheet metal roofing panels to comply with details shown and sheet metal roofing manufacturer's written instructions.

C. Fabricate sheet metal roofing to allow for expansion in running work sufficient to prevent leakage, damage, and deterioration of the Work. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and tool marks, true to line and levels indicated, and with exposed edges folded back to form hems.

1. Fold and cleat eaves as required by manufacturer to insure weather tightness and wind uplift resistance.
2. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of metal roofing to profiles, patterns, and drainage arrangements shown and as required for leak proof construction and wind uplift resistance.

D. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by manufacturers of dissimilar metals or by fabricator.

E. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Obtain field measurements for accurate fit before manufacturer fabrication.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal roof panel supports, and other conditions affecting performance of work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.

2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

3. For the record, prepare written report for the General Contractor, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal roof panels to verify actual locations of penetrations relative to seam locations of metal roof panels before metal roof panel installation.

3.02 PREPARATION

A. Lay out and examine substrate before installation of sheet metal roofing. Space fasteners as required to resist design uplift, but not more than 24 inches o.c.
B. Install flashings and other sheet metal to comply with requirements specified in Division 7 Section "Sheet Metal Flashing and Trim."

3.03 INSTALLATION, GENERAL

A. General: Anchor sheet metal roofing and other components of the Work securely in place, with provisions for thermal and structural movement. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required for a complete roofing system and as recommended by fabricator for sheet metal roofing.

1. Field cutting of sheet metal roofing by torch is not permitted.

2. Rigidly fasten ridge end of sheet metal roofing and allow for positive panel attachment as per manufacturer’s recommendations. All flashing details shall accommodate thermal movement.

3. Provide metal closures at peaks, ridge, gable and hip caps.

4. Flash and seal sheet metal roofing with weather closures at eaves, rakes, and at perimeter of all openings. Fasten with self-tapping screws.

5. Locate roofing splices over, but not attached to, structural supports. Stagger roofing splices and end laps to avoid a four-panel lap splice condition.

6. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the material.

B. Fasteners: Use fasteners of size and length as required for compatibility with substrate.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by fabricator of sheet metal roofing or manufacturers of dissimilar metals.

1. Separate sheet metal roofing from bituminous coating where roofing will contact wood, ferrous metal, or cementitious construction. Interlock and overlap shingles and stagger end joints from shingles above and below according to shingle manufacturer’s written instructions.
D. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

3.04 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete sheet metal roofing assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

2. Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual" and NRCA Waterproofing Manual. Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.05 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as sheet metal roofing is installed. On completion of sheet metal roofing installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect completed metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

END OF SECTION
SECTION 07600
FLASHING AND SHEET METAL

PART 1    GENERAL

1.01   SECTION INCLUDES
A. Requirements for galvanized flashing and trim.

1.02   STANDARDS AND REGULATIONS

1.03   RESTRICTIONS AND QUALITY CONTROL
A. Provide a fabricator regularly engaged in the fabrication of each specified material.

1.04   SUBMITTALS
A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimension of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:
   1. Identify material, thickness, weight, and finish for each item and location in Project.
   2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
   3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clip, cleats, and attachments to adjoining work.
   4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.
1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long. Include fasteners, cleats, clips, closures, and other attachments.

2. Trim: 12 inches long. Include fasteners and other exposed accessories.

3. Accessories: Full-size Sample.

E. All submittals are to be in accordance with Section 01300 – Submittals.

1.05 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA’s “Architectural Sheet Metal Manual.” Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1. Copper Standard: Comply with CDA’s “Copper in Architecture Handbook.”

B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave fascia, fascia trim, approximately 48 inches long, including supporting construction cleats, seams, attachments, underlayment, and accessories.

2. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

4. Approval mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 DELIVERY, STORAGE, AND HANDLING
A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim material in contact with other materials that might cause staining, denting, or other surface damage.

1.07 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Sheet Metal: Galvanized steel conforming to ASTM A 525 and A 526 or A 527 commercial quality G 90.

B. Flux for Solder: Conforming to FS O-F-506, Type I for galvanized metal.

C. Solder: ASTM B 32, 63 percent tin and 37 percent lead.

D. Electrodes: AWS A5.22, Type E308L-16.

E. Nails, Screws and Rivets: 18-8 stainless steel.

F. Rosin-Sized Sheathing: Conforming to FS UU-B-790, Type I, inorganic fiber coated both sides and weighing not less than 4 pounds per 100 square feet.

G. Tin: New block material, commercial tin.


I. Bituminous Coating: Conforming to FS TT-C-494

J. Stainless Steel – No 4 Finish

2.02 FINISHES
A. Exterior: 0.2 mil thick off-white corrosion-resistant primer (also applied to underside of standing seam roof) and 0.8 mil thick finish coat of Poly-vinylidene Fluoride (PVF2), full 70% Kynar 500/Hylar 5000, or approved equal, for a total of 1.0 mil dry film thickness.

2.03

A. Roof and Roof to Wall Transition Expansion-Joint Cover: Fabricate from one of the following materials:

1. Copper: 16 oz./sq. ft.
2. Lead-Coated Copper: 17.2 oz./sq. ft.
3. Stainless Steel: 0.0250 inch thick.
4. Galvanized Steel: 0.0336 inch thick.
5. Aluminum-Zinc Alloy-Coated Steel: 0.0336 inch thick.
6. Prepainted, Metallic-Coated Steel: 0.0336 inch thick.
7. Zinc: 0.031 inch, 0.040 inch thick.

B. Base Flashing: Fabricate from one of the following materials:

1. Copper: 20 oz./sq. ft.
2. Lead-Coated Copper: 21.2 oz./sq. ft.
3. Stainless Steel: 0.0187 inch thick.
4. Galvanized Steel: 0.0276 inch thick.
5. Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.
6. Prepainted, Metallic-Coated Steel: 0.0276 inch thick.
7. Zinc: 0.031 inch, 0.040 inch thick.

C. Counterflashing: Fabricate from the following material:

1. Stainless steel: 0.0250 inch thick.

D. Roof-Penetration Flashing: Fabricate from the following material:

1. Lead: 4.0 lb/sq. ft., hard tempered.
2.04 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:
   1. Lead-Coated Copper: 17.2 oz./sq. ft.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of work.
   1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Transmit submittals required by this Section.

B. Furnish products as indicated.

C. Ensure that substrates are in suitable condition to receive the work.

3.03 FABRICATION AND INSTALLATION


3.04 FORMING

A. Form sheet metal to the dimensions and shapes required with molded and broken surfaces true and angles accurate.

B. Form flat-locked seams that are not subject to stress, 1/2 inch wide. Flat locked seams that are subject to stress, 1 inch wide.

C. Form lap expansion seams not less than 4 inches wide and fill with white lead or other caulking material.

D. Cap flat seams in the direction of flow where exposed to the weather.

E. Provide 1/2-inch hem (minimum) at exposed edges of sheet metal.
F. Provide a minimum of one lap expansion seam in any straight run of 4 feet or more, not more than 8 feet from any corner and at not more than 16 feet on center in straight runs.

G. Punch or drill and rivet, providing invisible rivets and seams, where multiple layers of metal occur. Continuously solder or weld the folded edges and wipe or grind smooth to provide texture to match surrounding metal.

H. Fabricate flashing for corners of the building at least 4 feet long in each direction.

I. Minimum radius of break in sheet metal shall be twice the thickness of the metal.

J. Miter corners and join by locked and soldered joints.

K. Furnish and install reglets for flashing in the forms for concrete and within other materials.

3.05 WELDING

A. Weld with direct current, reverse polarity equipment utilizing the minimum current to minimize distortion of the metal.

B. Utilize start and run-off tabs to assure uniformity of weld terminations.

3.06 SOLDERING

A. Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except where pre-tinned surface would show in finished Work.

1. Do not solder pre-painted, metallic-coated steel.

2. Pre-tinning is not required for lead-coated copper, zinc-tin alloy-coated stainless steel and lead.

3. Stainless-Steel Soldering: Pre-tin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.

4. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
5. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.


7. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

3.07 INSTALLATION, GENERAL

A. Install sheet metal with continuous concealed clips of the same gauge, in lengths not exceeding 8 feet, spaced 1/8 inch apart for expansion, and fastened to the structure at not more than 8 inches on center. Fold fastened edge of the clips back over the fastener.

B. Apply rosin-sized sheathing as a barrier between asphalt products and the sheet metal. Lap sheathing not less than 4 inches and fasten to the structure.

C. Install sleeves for roof penetrations with 4-inch flanges and 10-inch high flared top counter flashing with 1/8 inch by 1-1/2 inch drawband. Sleeves shall match metal standing seam roofing configuration.

D. Separate dissimilar metals with fiber spacers or bituminous coatings.

E. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

F. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum, stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. **Underlayment:** Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.

3. **Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.**

**G.** Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

**H.** Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

**I.** Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

**J.** Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

**K.** Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

1. **Galvanized or Prepainted, Metallic-Coated Steel:** Use stainless-steel fasteners.

2. **Aluminum:** Use aluminum or stainless-steel fasteners.

3. **Copper:** Use copper, hardware bronze, or stainless-steel fasteners.

4. **Stainless Steel:** Use stainless-steel fasteners.

### 3.08 ROOF DRAINAGE SYSTEM INSTALLATION
A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Downspouts: Join sections with 1-1/2-inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Connect downspouts to underground drainage system indicated.

C. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches in direction of water flow.

D. Leaders: Provide aluminum leaders

3.09 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch centers.

C. Pipe or Post Counterflushing: Install counterflushing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.

2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.
3.10 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Openings Flashing in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.11 MISCELLANEOUS FLASHING INSTALLATION

A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.12 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION
1.01 SUMMARY
A. Section Includes:
   1. Snow guard system for metal roofs.
   2. Non-penetrating attachment system.
   3. Color-matched metal strips.
B. Related Sections:
   1. Division 1: Administrative, procedural, and temporary work requirements.
   2. Section 07410 - Metal roof and Wall Panels

1.02 REFERENCES
A. Aluminum Association (AA) - Aluminum Standards and Data, 2003 Edition.
B. ASTM International (ASTM):

1.03 SYSTEM DESCRIPTION
A. Attachment system to provide attachment to standing seam metal roofs:
   1. With only minor dimpling of panel seams.
   2. Without penetrations through roof seams or panels.
   3. Without use of sealers or adhesives.
   4. Without voiding roof warranty.
B. Loading: Design snow guard system to resist minimum in-service vector load in pounds per linear foot of eave, as required by code.

C. Factor of safety: Utilize a factor of safety as per code to determine allowable loads from ultimate tested clamp tensile load values.

1.04 SUBMITTALS

A. Submittals for Review:
   1. Shop Drawings: Show locations of snow guards on roof and attachment spacing.
   3. Samples:
      a. Clamp samples.
      b. 24 inch long cross member samples including color-matched metal strip, splice connector, and other hardware.

B. Quality Control Submittals:
   1. Test results: Results of product load testing, issued by a recognized independent testing laboratory, showing load-to-failure value of attachment.

C. Closeout Submittals:
   1. Certification: Installer's certification that snow guard system was installed in accordance with manufacturer's instructions and approved Shop Drawings.

1.05 QUALITY CONTROL

A. Mockup:
   1. Size: Minimum 8 feet long.
   2. Show: Snow guard attachment, cross members, and accessories.
   3. Approved mockup may remain as part of the Work.

B. Installer Qualifications: Installer of snow guards is a certified installer with a documented history installing manufacturer's
products according to manufacturer’s specifications.

1.06 WARRANTIES
A. Provide manufacturer’s 1 year warranty providing coverage against defects in materials and workmanship.

1.07 MAINTENANCE
A. Extra Materials: Provide 30 extra clamps with set screws and attachment bolts.

1.08 DELIVERY, STORAGE, AND HANDLING
A. Package so that products will not be damaged during shipping or storage.
B. Clearly label each package of contents. Label shall be on (2) ends and (1) face. Contents shall be labeled and coordinated with installation drawings.
C. Ship items to SEPTA location as described in purchase requisition.

PART 2 - PRODUCTS

2.01 SNOW RETENTION RAILS
A. Manufacturer
   1. Contract Documents are based on S-5! ColorGard by Metal Roof Innovations, Ltd.
   2. Or approved equal

B. Cross Members:
   1. Manufactured from 6061-T6 alloy and temper aluminum extrusions conforming to ASTM B221 and AA Aluminum Standards and Data.
   2. Receptacle in face to receive color-matched metal strips.
   3. Provide splice connectors ensuring alignment and structural continuity at end joints.

C. Color Strips: Same material and finish as roof panels; obtained from roof panel manufacturer.

D. Snow and Ice Clips: Aluminum, with rubber foot, minimum 3 inches wide.

2.02 COMPONENTS
A. Clamps:
   1. Manufactured from 6061-T6 aluminum extrusions conforming to ASTM B221 or aluminum castings conforming to ASTM B85 and to AA Aluminum Standards and Data.
   2. Clamp model: No. S-5
   3. Set screws: 300 Series stainless steel, 18-8 alloy, 3/8 inch diameter, with round nose point.
   4. Attachment bolts: 300 Series stainless steel, 18-8 alloy, 10 mm diameter, with flat washers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to beginning installation, verify that:
   1. Panel seaming is complete.
   2. Panel attachment is sufficient to withstand loads applied by snow guard system.
   3. Installation will not impede roof drainage.

3.02 PREPARATION

A. Clean areas to receive attachments; remove loose and foreign matter that could interfere with installation or performance.

3.03 INSTALLATION

A. Install system in accordance with manufacturer's instructions and approved Shop Drawings.

B. Place clamps at maximum 32 inches on center or as required by in-service loads.

C. Place clamps in straight, aligned rows.

D. Place both set screws on same side of clamp.

E. Tighten set screws to manufacturer's recommended torque. Randomly test set screw torque using calibrated torque wrench.

F. Insert color-matched metal strips into cross members, staggering strips to cover cross member joints.
G. Attach cross members to clamps; tighten bolts to manufacturer’s recommended torque.

H. Install splice connectors at cross member end joints.

I. Do not cantilever cross members more than 4 inches beyond last clamp at ends.

J. Install Snow clips at spacing’s indicated on shop drawings

END OF SECTION
SECTION 07900

JOINT SEALERS

PART 1    GENERAL

1.01    DESCRIPTION

A. Section covers all sealant and caulking materials and their application, wherever required for complete installation of building materials or systems.

1.02    RELATED WORK

A. Section 04210 – Clay Masonry Unit
B. Section 04220 - Concrete Masonry Units
C. Section 08520 – Aluminum Windows
D. Section 07410 - Metal Roof and Wall Panels
E. Section 07600 - Flashing and Sheet metal
F. Section 08100 - Steel Doors and Frames
G. Section 10200 – Louvers and Vents
H. Section 13121 - Pre-Fabricated Station Building & Canopy.

1.03    SUBMITTALS

A. Submit in accordance with Section 01300.
B. Manufacturer's installation instructions for each product used.
C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
D. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
E. Joint-Sealant Schedule: Include the following information:
   1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.


F. Manufacturer's Literature and Data:

1. Caulking compound

2. Primers

3. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

1.04 QUALITY CONTROL

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021.

2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.

3. Test elastomeric joint sealants according to SWRI’s Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.

4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to joint substrates in accordance with sealant manufacturer’s recommendations:

1. Locate test joints where indicated or, if not indicated, as directed by Engineer / Architect.
2. Conduct field tests for each application indicated below:
   a. Each type of elastomeric sealant and joint substrate indicated.
   b. Each type of non-elastomeric sealant and joint substrate indicated.

3. Notify Engineer seven days in advance of dates and times when test joints will be erected.

4. Arrange for tests to take place with joint sealant manufacturer’s technical representative present

1.05 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Do not proceed with installation of joint sealants under following conditions:
      a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 °F.
      b. When joint substrates are wet.

B. Joint-Width Conditions:
   1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:
   1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.06 DELIVERY, HANDLING, AND STORAGE

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 90 °F or less than 40 °F.

1.07 DEFINITIONS
A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Back-up Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.08 WARRANTY

A. General Warranty: Warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Design-Builder under requirements of the Contract Documents.

B. Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Final Acceptance.

C. Standard Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 20 years from date of Final Acceptance.

D. Warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.09 APPLICABLE PUBLICATIONS
A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

1. C 509-00: Elastomeric Cellular Preformed Gasket and Sealing Material.
2. C 612-00: Mineral Fiber Block and Board Thermal Insulation.
4. C 834-00: Latex Sealants.
7. C 1021-01: Laboratories Engaged in Testing of Building Sealants

C. Sealant, Waterproofing and Restoration Institute (SWRI).

1. The Professionals’ Guide

PART 2 PRODUCTS

2.01 SEALANTS

A. S-1:

1. ASTM C 920, polyurethane or polysulfide.
2. Type M.
3. Class 25.
4. Grade NS.
5. Shore A hardness of 20-40
B. S-2:
   1. ASTM C 920, polyurethane or polysulfide.
   2. Type M.
   3. Class 25.
   4. Grade P.

C. S-3:
   1. ASTM C 920, polyurethane or polysulfide.
   2. Type S.
   3. Class 25, joint movement range of plus or minus 50 percent.
   4. Grade NS.
   6. Minimum elongation of 700 percent.

D. S-4:
   1. ASTM C 920 polyurethane or polysulfide.
   2. Type S.
   3. Class 25.
   4. Grade NS.

E. S-5:
   1. ASTM C 920, polyurethane or polysulfide.
   2. Type S.
   3. Class 25.
   4. Grade P.
F. S-6:
   1. ASTM C 920, silicone, neutral cure.
   2. Type S.
   3. Class: Joint movement range of plus 100 percent to minus 50 percent.
   4. Grade NS.
   6. Minimum elongation of 1200 percent.

G. S-7:
   1. ASTM C 920, silicone, neutral cure.
   2. Type S.
   3. Class 25.
   4. Grade NS.
   6. Structural glazing application.

H. S-8:
   1. ASTM C 920, silicone, acetoxy cure.
   2. Type S.
   3. Class 25.
   4. Grade NS.
   6. Structural glazing application.

I. S-9:
   1. ASTM C 920 silicone.
   2. Type S.
   3. Class 25.
4. Grade NS.

J. S-10:
1. ASTM C 920, coal tar extended fuel resistance polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.

K. S-11:
1. ASTM C 920 polyurethane.
2. Type M/S.
3. Class 25.
4. Grade P/NS.
5. Shore A hardness of 35 to 50.

L. S-12:
1. ASTM C 920, polyurethane.
2. Type M/S.
3. Class 25, joint movement range of plus or minus 50 percent.
4. Grade P/NS.
5. Shore A hardness of 25 to 50.

2.02 CAULKING COMPOUND

A. C-1: ASTM C 834, acrylic latex.

B. C-2: One component acoustical caulking, non-drying, non hardening, synthetic rubber.

2.03 COLOR
A. Sealants used with exposed masonry shall match color of mortar joints.

B. Sealants used with unpainted concrete shall match color of adjacent concrete.

C. Color of sealants for other locations shall be light gray or aluminum, unless specified otherwise.

D. Caulking shall be light gray or white, unless specified otherwise.

2.04 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Backup Rod Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

2. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 °F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.05 FILLER


B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.06 PRIMER

A. As recommended by manufacturer of caulking or sealant material.
B. Stain free type.

2.07 CLEANERS-NON POUROUS SURFACES

A. Chemical cleaners acceptable to manufacturer of sealants and sealant backing material free of oily residues and other substances capable of staining or harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.02 PREPARATIONS

A. Prepare joints in accordance with manufacturer's instructions and SWRI.

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.

1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.

2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

   a. Concrete.
   
   b. Masonry.
   
   c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
a. Metal.
b. Glass.
c. Porcelain enamel.
d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Apply primer to sides of joints wherever required by compound manufacturer's printer instructions.
   1. Apply primer prior to installation of back-up rod or bond breaker tape.
   2. Use brush or other approved means that will reach all parts of joints.

F. Take all necessary steps to prevent three sided adhesion of sealants.

3.03 BACKING INSTALLATION

A. Install back-up material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the back-up rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of back-up rod and sealants.

D. Install back-up rod, without puncturing the material, to a uniform depth, within plus or minus 1/8 inch for sealant depths specified.

E. Where space for back-up rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

F. Take all necessary steps to prevent three sided adhesion of sealants.

3.04 SEALANT DEPTHS AND GEOMETRY
A. At widths up to 1/4 inch, sealant depth equal to width.

B. At widths over 1/4 inch, sealant depth 1/2 of width up to 1/2 inch maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.05 INSTALLATION

A. General:

1. Apply sealants and caulking only when ambient temperature is between 40 and 100 degrees F.

2. Do not use polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.

3. Do not use sealant type listed by manufacture as not suitable for use in locations specified.

4. Apply caulking and sealing compound in accordance with manufacturer’s printer instructions.

5. Avoid dropping or smearing compound on adjacent surfaces.

6. Fill joints solidly with compound and finish compound smooth.

7. Tool joints to concave surface unless shown or specified otherwise.

8. Finish paving or floor joints flush unless joint is otherwise detailed.

9. Apply compounds with nozzle size to fit joint width.

10. Test sealants for compatibility with each other and substrate. Use only compatible sealant.

B. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise.

3.06 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as recommended by sealant manufacturer:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

   a. Perform 10 tests for first 1000 feet of joint length for each type of elastomeric sealant and joint substrate.
b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

C. Inspect tested joints and report on following:

1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.

2. Compare these results to determine if adhesion passes sealant manufacturer’s field-adhesion hand-pull test criteria.

3. Whether sealants filled joint cavities and are free from voids.

4. Whether sealant dimensions and configurations comply with specified requirements.

D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.07 CLEANING

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by the caulking or sealant manufacturer.

B. After filling and finishing joints, remove masking tape.

C. Leave adjacent surfaces in a clean and unstained condition.

3.08 LOCATIONS
A. Exterior Building Joints, Horizontal and Vertical:
   1. Metal to Metal: Type S-1, S-2
   2. Metal to Masonry or Stone: Type S-1
   3. Masonry to Masonry or Stone: Type S-1
   4. Stone to Stone: Type S-1
   5. Cast Stone to Cast Stone: Type S-1
   6. Threshold Setting Bed: Type S-1, S-3, S-4
   7. Masonry Expansion and Control Joints: Type S-6
   8. Wood to Masonry: Type S-1

B. Metal Reglets and Flashings:
   1. Flashings to Wall: Type S-6
   2. Metal to Metal: Type S-6

C. Sanitary Joints:
   1. Walls to Plumbing Fixtures: Type S-9
   2. Counter Tops to Walls: Type S-9
   3. Pipe Penetrations: Type S-9

D. Horizontal Traffic Joints:
   1. Concrete Paving, Unit Pavers: Type S-11 or S-12
   2. Garage/Parking Decks: Type S-10

E. High Temperature Joints over 204 degrees C (400 degrees F):
   1. Exhaust Pipes, Flues, Breech Stacks: Type S-7 or S-8

F. Interior Caulking:
   1. Typical Narrow Joint 1/4 inch or less at Walls and Adjacent Components: Type C-1, C-2, C-3.
   2. Perimeter of Doors, Windows, Access Panels which Adjoin Concrete or Masonry Surfaces: Type C-1, C-2, C-3.
3. Joints at Masonry Walls and Columns, Piers, Concrete Walls or Exterior Walls: Type C-1, C-2, C-3.

4. Perimeter of Lead Faced Control Windows and Plaster or Gypsum Wallboard Walls: Type C-1, C-2, C-3.

5. Exposed Isolation Joints at Top of Full Height Walls: Type C-1, C-2, C-3.

6. Exposed Acoustical Joint at Sound Rated Partitions Type C-2

7. Concealed Acoustic Sealant Type S-4, C-1, C-2, C-3.

END OF SECTION
THIS PAGE NOT USED
PART 1  GENERAL

1.01  SUMMARY

A. Section Includes:
   1. Standard hollow metal interior doors and frames.
   2. Standard hollow metal exterior doors and frames.

B. Related Sections:
   1. Section 08710 “Door Hardware” for door hardware for hollow metal doors.
   2. Section 09900 “Painting” for field painting hollow metal doors and frames.
   3. Section 13121 - Pre-Fabricated Station Building and Canopy

1.02  REFERENCES

A. American Society of Testing Materials (ASTM): Materials and testing standards as identified throughout this Section.
   1. A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. C236 Test Method for Steady State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
   3. C976 Test Method for Thermal Performance of Building Assemblies by Means of a Calibrated Hot Box
   4. E152 Fire Tests of Door Assemblies


C. Door Hardware Institute (DHI): Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

D. National Fire Protection Association (NFPA):

E. Steel Door Institute (SDI):
   1. ANSI/SDI-100 Recommended Specifications for Standard Steel Doors and Frames
   2. ANSI/SDI-105 Recommended Erection Instructions for Steel Frames
   3. ANSI/SDI-112 Galvanized Standard Steel Doors and Frames
   4. ANSI/SDI-117 Manufacturing Tolerances Standard Steel Doors and Frames

F. Underwriters Laboratories (UL): UL 10B, Fire Tests for Door Assemblies.

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.

1.04 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.05 RESTRICTIONS AND QUALITY CONTROL

A. Applicable Standards: Specifications and standards of SDI 100-98.

B. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

C. Installer Qualification: Experience with installation of similar materials.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E152 "Standard Methods of Fire Tests of Door Assemblies" by nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.
1.06 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, and finishes.

B. Shop Drawings: Include the following:
   1. Elevations of each door design.
   2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing where applicable.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Other Action Submittals:
   1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.
   2. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

   1. Provide additional protection to prevent damage to finish of factory-finished units.
B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.

   1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.08 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.09 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   1. Amweld Building Products, LLC.
   2. Benchmark; a division of Therma-Tru Corporation.
   3. Ceco Door Products; an Assa Abloy Group company.
   4. Curries Company; an Assa Abloy Group company.
   5. Deansteel Manufacturing Company, Inc.
   7. Fleming Door Products Ltd.; an Assa Abloy Group company.
10. Kewanee Corporation (The).
11. Mesker Door Inc.
14. Steelcraft; an Ingersoll-Rand company.
15. Windsor Republic Doors
16. Or Engineer’s approved equal

2.02 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings[ and temperature-rise limits] indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.03 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.

2. Doors:
   a. Type: As indicated in the Door and Frame Schedule.
2.04 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3. At locations indicated in the Door and Frame Schedule

1. Physical Performance: Level A according to SDI A250.4.

2. Doors:

a. Type: As indicated in the Door and Frame Schedule.

b. Thickness: 1-3/4 inches

c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.

d. Edge Construction: Model 2, Seamless

e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.

1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

3. Frames:
a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.

b. Construction: Knocked down.


2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.

3. Minimum four (4) anchors per door jamb, 24 inches on center maximum.

B. Head: Provide minimum of two (2) anchors at frames over 2’-6” wide; 24 inches on center, maximum.

C. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.06 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

G. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

H. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

I. Glazing: Comply with requirements in Section 088000 "Glazing."

2.07 FABRICATION

A. Fabricate doors to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer’s plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Hollow-Metal Doors:
   1. Fire Door Cores: As required to provide fire-protection ratings indicated.
   2. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches
   3. Top Edge Closures: Close top edges of doors with inverted closures of same material as face sheets.
   4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
   5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

4. Jamb Anchors: Provide number and spacing of anchors as follows:
   a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
      1) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      2) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.
   b. Compression Type: Not less than two anchors in each jamb.
   c. Post-installed Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

5. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section 08710 "Finish Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.

G. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
   1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
   4. Provide loose stops and moldings on inside of hollow-metal work.
   5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.08 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pre-treating.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Factory-Applied Paint Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.

C. Color and Gloss: As indicate in the Finish Schedule, to be selected by Architect

PART 3 EXECUTION

3.01 EXAMINATION
A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Installer Qualifications: Installer of steel doors and frames is a certified installer with experience installing manufacturer's products according to manufacturer's specifications.

C. Hollow Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.

b. Field welding of frames is not permitted.

c. Install frames with removable glazing stops located on secure side of opening.

d. Install door silencers in frames before grouting.

e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.


4. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.

5. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.

6. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

D. Metal Doors: Fit metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3. Smoke-Control Doors: Install doors according to NFPA 105.

E. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.03 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

D. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION
SECTION 08310
ACCESS DOORS AND PANELS

PART 1    GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY
A. Section Includes:
   1. Access doors and frames for ceilings.

1.03 ACTION SUBMITTALS
A. Product Data: For each type of product.
   1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. Detail fabrication and installation of access doors and frames for each type of substrate.
C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
D. Product Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.

1.04 DELIVERY, STORAGE, AND HANDLING
A. Deliver access doors and panels, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
   1. Provide additional protection to prevent damage to finish of factory-finished units.
B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.
C. Stack materials on platforms or pallets, covered with suitable weathertight and vented covering. Do not store sheet metal flashing and trim material in contact with other materials that might cause staining, denting, or other surface damage.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics according to the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.02 ACCESS DOORS AND FRAMES FOR CEILINGS

A. Manufacturer’s

1. Acudor Products, Inc.
3. Nystrom, Inc.
4. Or approved Equal

B. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.

C. Flush Access Doors with Exposed Flanges

1. Assembly Description: Fabricate door to fit flush to frame. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. Locations: Ceiling.
3. Door Size: 24"x24" min.
4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage
5. Frame Material: Same material, thickness, and finish as door
6. **Hinges**: Manufacturer's standard
7. **Hardware**: Lock.

### D. Fire-Rated, Flush Access Doors with Exposed Flanges

1. **Assembly Description**: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide manufacturer's standard-width exposed flange, proportional to door size.
2. **Locations**: Ceiling
3. **Fire-Resistance Rating**: Not less than that of adjacent construction
4. **Uncoated Steel Sheet for Door**: Nominal 0.036 inch, 20 gage
   a. **Finish**: Factory finish.
5. **Frame Material**: Same material, thickness, and finish as door
6. **Hinges**: Manufacturer's standard
7. **Hardware**: Lock.

### 2.03 MATERIALS

A. **Steel Plates, Shapes, and Bars**: ASTM A 36/A 36M.

B. **Steel Sheet**: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

C. **Aluminum Extrusions**: ASTM B 221, Alloy 6063-T6.


E. **Aluminum Sheet**: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15; with minimum sheet thickness according to ANSI H35.2.

F. **Frame Anchors**: Same type as door face.

G. **Inserts, Bolts, and Anchor Fasteners**: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

### 2.04 FABRICATION
A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
   1. Provide mounting holes in frames for attachment of units to metal or wood framing.
   2. Provide mounting holes in frame for attachment of masonry anchors.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder locks, furnish two keys per lock and key all locks alike.
   2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.05 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Steel and Metallic-Coated-Steel Finishes:
   1. Factory Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, with a minimum dry-film thickness of 1 mil for topcoat.

PART 3 EXECUTION

3.01 EXAMINATION
A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.03 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION
SECTION 08520
ALUMINUM WINDOWS

PART 1   GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and
      Supplementary Conditions and Division 1 Specification Sections, apply to
      this Section.

1.02 SUMMARY
   A. This Section includes Architectural Grade aluminum windows of the
      performance class indicated. Window types required include the following:
      1. Fixed windows.
   B. Related Sections
      1. Section 07900 – Joint Sealers
      2. Section 08800 - Glazing

1.03 DEFINITIONS
   A. Performance class number, included as part of the window designation
      system, is the actual design pressure in pounds force per square foot used
      to determine structural test pressure and water test pressure.
      1. Structural test pressure, wind load test, is equivalent to 150 percent of
         the design pressure.

1.04 PERFORMANCE REQUIREMENTS
   A. General: Provide aluminum windows engineered, fabricated, and installed
      to withstand normal thermal movement, wind loading, and impact loading
      without failure, as demonstrated by testing manufacturer's standard window
      assemblies representing types, grades, classes, and sizes required for
      Project according to test methods indicated.
   B. Test Criteria: Testing shall be performed by a qualified independent testing
      agency based on the following criteria:
      1. Design wind velocity at Project site is 100 mi./h (113 km/h).
2. Test Procedures: Test window units according to ASTM E 283 for air infiltration, ASTM E 547 for water penetration, and ASTM E 330 for structural performance.

3. Test Procedures: Test window units according to ASTM E 283 for air infiltration, both ASTM E 331 and ASTM E 547 for water penetration, and ASTM E 330 for structural performance.

4. Test Procedures: Test window units according to ASTM E 283 for air infiltration, ASTM E 331 for water penetration, and ASTM E 330 for uniform load deflection and structural performance.

C. Performance Requirements: Testing shall demonstrate compliance with requirements indicated in AAMA 101 for air infiltration, water penetration, and structural performance for type, grade, and performance class of window units required. Where required design pressure exceeds the minimum for the specified window grade, comply with requirements of AAMA 101, Section 3, "Optional Performance Classes," for higher than minimum performance class.

1. Air-Infiltration Rate for Fixed Windows: Not more than 0.06 cfm/ft. (1.09 cu. m/h per m) of area for an inward test pressure of 6.24 lbf/sq. ft. (299 Pa).

2. Water Penetration: No water penetration as defined in the test method at an inward test pressure of 20 percent of the design pressure.

3. Uniform Load Deflection: No deflection in excess of 1/175 of any member's span during the imposed load, for a positive (inward) and negative (outward) test pressure of 60 lbf/sq. ft. (2873 Pa).

4. Structural Performance: No failure or permanent deflection in excess of 0.4 percent of any member's span after removing the imposed load, for a positive (inward) and negative (outward) test pressure of 30 lbf/sq. ft. (1437 Pa).

5. Condensation Resistance: Where window units are indicated to be "thermally improved," provide units tested for thermal performance according to AAMA 1503.1 showing a condensation resistance factor (CRF) of 58.

6. Thermal Transmittance: Provide window units with a U-value maximum of 0.55 Btu/sq. ft. x h x deg F (3.9 W/sq. m x K) at 15-mi./h (24-km/h) exterior wind velocity, when tested according to AAMA 1503.1.
7. Forced-Entry Resistance: Comply with Performance Level 10 requirements when tested according to ASTM F 588.

8. Thermal Movements: Provide window units that allow thermal movement resulting from the following maximum change (range) in ambient temperature when engineering, fabricating, and installing aluminum windows to prevent buckling, opening of joints, and overstressing of components, connections, and other detrimental effects. Base engineering calculation on actual surface temperatures of materials due to solar heat gain and nighttime sky heat loss.

   a. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.05 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each type of window required, including the following:
   1. Construction details and fabrication methods.
   2. Material descriptions including glazing and fabrication methods
   3. Dimensions of individual components and profiles
   4. Data on hardware, accessories, and finishes.
   5. Recommendations for maintaining and cleaning exterior surfaces.

C. Shop Drawings showing fabrication and installation of each type of window required including information not fully detailed in manufacturer's standard Product Data and the following:
   1. Layout and installation details, including anchors flashing and sealant.
   2. Elevations at 1/4 inch = 1 foot (1:50) scale and typical window unit elevations at 3/4 inch = 1 foot (1:20) scale.
   3. Full-size section details of typical composite members, including reinforcement and stiffeners.
   4. Location of weep holes.
   5. Panning details.
   6. Hardware, including operators.
7. Window cleaning provisions.

8. Glazing details.


D. Samples for initial color selection on 12-inch- (300-mm-) long sections of window members. Where finishes involve normal color variations, include Sample sets showing the full range of variations expected.

E. Samples for Verification: The Engineer reserves the right to require additional samples that show fabrication techniques, workmanship, and design of hardware and accessories.

F. Test reports from a qualified independent testing agency indicating that each type, grade, and size of window unit complies with performance requirements indicated based on comprehensive testing of current window units within the last 5 years. Test results based on use of down-sized test units will not be accepted.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports, and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Engineer's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
D. Single-Source Responsibility: Obtain aluminum windows from one source and by a single manufacturer.

E. Mockups: Prior to installing aluminum windows, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.

1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Engineer.

2. Notify Engineer one week in advance of the dates and times when mockups will be constructed.

3. Demonstrate the proposed range of aesthetic effects and workmanship.

4. Obtain Engineer's approval of mockups before start of final unit of Work.

5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   a. When directed, demolish and remove mockups from Project site.
   b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

F. Product Options: The Drawings indicate sizes, profiles, dimensional requirements, and aesthetic effects of aluminum windows and are based on the specific window types and models indicated. Other aluminum window manufacturers whose products have equal performance characteristics may be considered provided deviations in size, profile, and dimensions are minor and do not alter the aesthetic effect. Refer to Division 1 Section "Substitutions."

1.08 PROJECT CONDITION

A. Field Measurements: Check window openings by field measurements before fabrication and show recorded measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Where field measurements cannot be made without delaying the Work, guarantee opening dimensions and proceed with fabricating aluminum windows without field measurements. Steel truss and structural steel drawings must be approved before the windows will be
reviewed. Coordinate wall construction to ensure that actual opening dimensions correspond to guaranteed dimensions.

1.09 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 01 Quality Requirements Section 01401.

B. Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer’s original unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

E. Store materials and accessories off ground, under cover, and protected from weather and construction activities.

1.10 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Failure to meet performance requirements.

   b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.

   c. Faulty operation of movable sash and hardware.

   d. Deterioration of materials and finishes beyond normal weathering.

   e. Failure of insulating glass.

2. Warranty Period:

   a. Window: 10 years from date of Substantial Completion.

   b. Glazing Units: 10 years from date of Substantial Completion.

   c. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 PRODUCTS
2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Thomas Manufacturing Inc.
2. Graham Architectural Products Corporation
3. TRACO Corporation
4. Or approved equal

2.02 ALUMINUM WINDOWS

A. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Fixed.

B. Frames:

1. Aluminum Extrusions: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi (150-MPa) ultimate tensile strength and not less than 0.125 inch (1.6 mm) thick at any location for main frame and sash members.

2. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Insulating-Glass Units

1. See Section 08800 - Glazing

D. Fasteners: Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.

1. Reinforcement: Where fasteners screw anchor into aluminum less than 0.125 inch (3.2 mm) thick, reinforce interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard, noncorrosive, pressed-in, splined grommet nuts.

2. Exposed Fasteners: Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware,
use fasteners that match finish of member or hardware being fastened, as appropriate.

E. Anchors, Clips, and Window Accessories: Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with requirements of ASTM B 633; provide sufficient strength to withstand design pressure indicated.

F. Compression-Type Glazing Strips and Weatherstripping: Unless otherwise indicated, and at manufacturer's option, provide compressible stripping for glazing and weatherstripping such as molded EPDM or neoprene gaskets complying with ASTM D 2000 Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D 2287, or molded expanded EPDM or neoprene gaskets complying with ASTM C 509, Grade 4.

G. Sliding-Type Weatherstripping: Provide woven-pile weatherstripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701.2.

1. Provide stripping with integral centerline barrier fin of semirigid plastic sheet of polypropylene.

H. Sealant: For sealants required within fabricated window units, provide type recommended by manufacturer for joint size and movement. Sealant shall remain permanently elastic, nonshrinking, and nonmigrating. Comply with Division 7 Section "Joint Sealers" of these Specifications for selection and installation of sealants.

2.03 ACCESSORIES

A. General: Provide manufacturer's standard accessories that comply with indicated standards.

B. Provide manufacturer's standard subsill and 2 piece receptor system.

C. Provide manufacturer’s mullions and stiffeners as required to meet 30lb wind pressure.

2.04 FIXED WINDOWS

A. Window Grade and Class: Comply with requirements of AAMA Grade and Performance Class F-AW50.

2.05 FABRICATION

A. General: Fabricate aluminum window units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.
1. Provide units that can be glazed without dismantling sash or ventilator framing.

2. Prepare window sash or ventilators for glazing, except where preglazing at the factory is indicated.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Thermally Improved Construction: Fabricate window units with an integral, concealed, low-conductance, thermal barrier, located between exterior materials and window members exposed on interior, in a manner that eliminates direct metal-to-metal contact.

   1. Provide thermal-break construction that has been in use for not less than 3 years, has been tested to demonstrate resistance to thermal conductance and condensation, and has been tested to show adequate strength and security of glass retention.

   2. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.

   3. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

   4. Provide water-shed members above side-hinged ventilators and similar lines of natural water penetration.

   5. Subframes: Provide subframes with anchors for window units as shown, of profile and dimensions indicated but not less than 0.062-inch (1.6-mm) thick extruded aluminum. Miter or cope corners, and weld and dress smooth with concealed mechanical joint fasteners. Finish to match window units.

   6. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated.

   7. Glazing Stops: Provide snap-on glazing stops, coordinated with glass selection and glazing system indicated. Finish to match window units.

E. Preglazed Fabrication: Preglaze window units at the factory where possible and practical for applications indicated. Comply with glass and glazing requirements of Division 8 Section "Glazing" of these Specifications and AAMA 101.
2.06 FINISHES

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 50 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: As selected by Architect from full range of industry colors and color densities

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect openings before installation. Verify that rough or masonry opening is correct and sill plate is level.

1. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.

2. Wood frame walls shall be dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure nail heads are driven flush with surfaces in opening and within 3 inches (75 mm) of opening.

3. Metal surfaces shall be dry; clean; free of grease, oil, dirt, rust and corrosion, and welding slag; without sharp edges or offsets at joints.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for installing window units, hardware, operators, and other components of the Work.

B. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.

1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with requirements specified under "Dissimilar Materials" Paragraph in appendix to AAMA 101.

C. Set sill members and other members in a bed of sealant or with joint fillers or gaskets, as shown on Shop Drawings, to provide weathertight construction. Refer to Division 7 Section "Joint Sealers" for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the Work.

1. Sealants, joint fillers, and gaskets to be installed after installation of window units are specified in another Division 7 Section

D. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.03 ADJUSTING

A. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and a weathertight closure.

3.04 CLEANING

A. Clean aluminum surfaces promptly after installing windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.
B. Clean glass of preglazed units promptly after installing windows. Comply with requirements of Division 8 Section "Glass and Glazing" for cleaning and maintenance.

3.05 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to aluminum window manufacturer, that ensure window units are without damage or deterioration at the time of Substantial Completion.

B. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.
SECTION 08710

DOOR HARDWARE

PART 1 GENERAL

1.01 DESCRIPTION
A. The work of this section consists of supplying and installing door hardware as shown on the contract drawings and specified herein.

B. The contractor shall be responsible for all aspects of delivery, storage and installation of all materials in accordance with the manufacturer's written instructions.

1.02 REFERENCES
A. American National Standards Institute (ANSI):
   1. ANSI A117.1 - Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People

1.03 RELATED SECTIONS
A. Division 1 – General Requirements
B. Section 08100 – Metal Doors

1.04 SUBMITTALS
A. Submit under the provisions of Sections 01300.
B. Submit Product Data for all hardware to be used.

1.05 QUALITY CONTROL
A. Conform to requirements of ANSI A117.1. Maintain one copy on site.

1.06 WARRANTY
A. Provide a five-year warranty on all products.

PART 2 PRODUCTS

2.01 HARDWARE
A. Deadbolt
1. Yale D Series, or approved equal.
2. Finish: 613 Dark Oxidized Satin Bronze
3. Yale Keyway, 6 Pin
4. 1” Throw

B. Deadbolt Strike Plate
1. Yale Model D243, Wood Frame Strike, or approved equal.
2. Finish: 613 Dark Oxidized Satin Bronze

C. Closers
1. Hager #5015, or approved equal.
2. Provide with Extra Heavy Duty Stop Arm
3. Provide Satin Brass Cover
4. ADA Compliant

D. Lever Locks
1. Yale 5400LN Series, or approved equal.
2. Style: Augusta, ADA Compliant
3. Finish: 613 Dark Oxidized Satin Bronze
4. Provide with standard strike plate with matching finish.

E. Push Plates
1. Hager Round Corner, Non-Beveled Push Plate #50T, or approved equal.
2. Bronze Construction
3. Size: 4”x16”
4. Finish: US10B

F. Push Bars
1. Hager Wide Push Bar #128P, or approved equal.
2. Bronze Construction
3. Size: 3/8”x3” sized for door width with 2” projection
4. Finish: US10B

G. Door Pulls
1. Hager Rectangular Wrought Door Pull #2J, or approved equal.
2. Bronze Construction
3. Finish: US10B
4. Pulls shall be thru-bolted to door.

H. Hinges
1. Hager Full Mortise Hinge #AB850, or approved equal.
2. Brass with Non-Removable Stainless Steel Pin
3. Three Knuckles
4. Provide with Steeple Tips
5. Provide (3) per door
6. Finish: US5

I. Aluminum Thresholds
1. Hager Aluminum Saddle Threshold full width and depth of door frame, or approved equal.
2. Finish: Dark Bronze, Anodized

J. Marble Thresholds
1. White Marble, full width and depth of door frame.

K. Weather-stripping
1. Door Sweep: Hager #750S Door Sweep, or approved equal.
2. Jamb: Haber #896S
3. Finish: Dark Bronze, Anodized
L. Silencers
   1. Hager #307D, or approved equal.
   2. Grey Rubber.
   3. Provide three (3) per door.
   4. Silencers shall be punched into frames.

M. Floor Stop
   1. Hager Universal Dome Stop #242F, or approved equal
   2. Cast Brass with Grey Rubber Bumper
   3. Finish: US26D

N. Coat Hook
   1. Hager Coat Hook #937P, or approved equal
   2. Brass Construction
   3. Finish: US26D

2.02 HARDWARE SCHEDULE

A. Entrance Doors
   1. Deadbolt Function: Cylinder (Keyed) both sides.
   2. Deadbolt Strike Plate
   3. Closer
   4. Push Plate (Interior)
   5. Push Bar (Interior)
   6. Door Pull (Exterior)
   7. Hinges
   8. Aluminum Thresholds
   9. Weather-stripping
   10. Silencers
B. Janitor’s and Communications Room Closets
   1. Deadbolt Function: Cylinder (Keyed) exterior, Blank interior.
   2. Deadbolt Strike Plate
   3. Lever Lock Function: Passage Latch (either lever operates latch bolt at all times)
   4. Hinges
   5. Marble Threshold
   6. Silencers
   7. Floor Stop

C. Restroom
   1. Lever Lock Function: Bath Lock (either lever operates latch bolt unless outside lever is locked by pushbutton inside)
   2. Hinges
   3. Marble Threshold
   4. Silencers
   5. Floor Stop
   6. Coat Hook

PART 3 EXECUTION

3.01 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions.
B. Use templates provided by hardware item manufacturer.
C. Adjusting:
   1. Adjust hardware for smooth operation.
D. Deliver keys to SEPTA Project Manager.
3.02 PROTECTION OF FINISHED WORK

A. Protect finished Work.
B. Do not permit adjacent work to damage hardware or finish.
C. Do not permit hardware to damage adjacent constructions and finishes.

END OF SECTION
SECTION 08800

GLAZING

PART 1  GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements apply to this section.

1.02 DESCRIPTION

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

1. Windows – Insulated laminated safety glazing
2. Doors – Insulated glazing

B. Related Sections:

1. Division 08 Section 08110 – Metal Doors and Frames
2. Division 08 Section 08520 – Aluminum Windows

1.03 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

1.04 SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glass Samples: For each type of [glass product other than clear monolithic vision glass] [the following products]; 12 inches (300 mm) square.

1. Laminated glass.
2. Insulating glass.

C. Glazing Accessory Samples: If specifically requested

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-e coatings and sealant testing agency.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Warranties: Warranties as Specified in This Section

1.06 QUALITY CONTROL

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: Installer of glazing is a certified installer with a documented history installing manufacturer’s products according to manufacturer’s specifications.

C. A qualified installer who employs glass installers for this Project who are certified under the National Glass Association’s Certified Glass Installer Program.

D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
E. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

F. Source Limitations for Glass: Obtain all glass from single source from single manufacturer for each glass type.

G. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

H. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."


I. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

J. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

K. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

L. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review temporary protection requirements for glazing during and after installation.
1.07 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.

1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.

2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.

3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.

4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

5. For materials failing tests, submit sealant manufacturer’s written instructions for corrective measures including the use of specially formulated primers.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer’s written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

1.10 WARRANTY

A. Manufacturer's Standard Warranty on Insulating Glass:
Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 5 years from date of Final Acceptance.

B. Manufacturer's Special Warranty for Laminated Glass:
Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.

2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
   a. Wind Design Data: As indicated on Drawings.
   b. Basic Wind Speed: 100 mph
   c. Importance Factor: 1.0.
   d. Exposure Category: C.

3. Design Snow Loads: 30 psf

4. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.

5. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

D. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with basic protection testing requirements in ASTM E 1996 for Wind Zone 1 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.

1. Large-Missile Test: For glazing located within 30 feet of grade.

2. Small-Missile Test: For glazing located more than 30 feet above grade.

E. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

F. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For laminated-glass lites, properties are based on products of construction indicated.

2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).

4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.

5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.02 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.


B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

1. Minimum Glass Thickness for Exterior Lites: as indicated on contract drawings

E. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass
as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.03 LAMINATED GLASS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFG Industries Inc,
2. Guardian Industries Corp.
3. Pilkington North America
4. RPG Industries
5. Or Engineer’s Approved Equal

B. Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written recommendations.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

C. Windborne-Debris-Impact-Resistant Laminated Glass: ASTM C 1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, with "Windborne-Debris-Impact Resistance" Paragraph in "Glass Products, General" Article, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Construction: Laminate glass with one of the following to comply with interlayer manufacturer's written recommendations:
   a. Polyvinyl butyral interlayer.
b. Polyvinyl butyral interlayers reinforced with polyethylene terephthalate film.

c. Ionoplast interlayer.

d. Cast-in-place and cured-transparent-resin interlayer.

e. Cast-in-place and cured-transparent-resin interlayer reinforced with polyethylene terephthalate film.

2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.

3. Interlayer Color: Clear unless otherwise indicated.

D. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Laminated-Glass Types" Article.

2.04 INSULATING GLASS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. APG Industries Inc

2. Guardian Industries Corp.

3. Pilkington North America

4. PG Industries

5. Or Engineer’s approved equal

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer’s standard, primary and secondary.

2. Spacer: Manufacturer’s standard spacer material and construction

3. Desiccant: Molecular sieve or silica gel, or a blend of both.
C. Glass: Comply with applicable requirements in "Glass Products" Article as indicated by designations in "Insulating-Glass Types" Article

2.05 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:

   1. Neoprene complying with ASTM C 864.
   2. EPDM complying with ASTM C 864.
   4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

   1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

C. Lock-Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock-strips, complying with ASTM C 542, black.

2.06 GLAZING SEALANTS

A. General:

   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D.

4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer’s full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Dow Corning Corporation; 790.
   b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
   d. Pecora Corporation; 890.
   e. Sika Corporation, Construction Products Division; SikaSil-C990.
   f. Tremco Incorporated; Spectrem 1.
   g. Or Engineer’s Approved Equal

2.07 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.

2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

### 2.08 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

### 2.09 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
   a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

B. Grind smooth and polish exposed glass edges and corners.
2.10 INSULATING-GLASS TYPES

A. Glass Type: Pyrolytic-coated, self-cleaning, low-maintenance, clear insulating glass.

1. Overall Unit Thickness: 1 inch (25 mm)
2. Thickness of Each Glass Lite: 5.0 mm
3. Outdoor Lite: Pyrolytic-coated, self-cleaning, low-maintenance, clear heat-strengthened float glass
4. Interspace Content: Argon
5. Indoor Lite: Fully tempered float glass
6. Provide safety glazing labeling.

2.11 SACRIFICIAL WINDOW FILM “VANDAL SHIELD”

A. Manufacturer's

1. GPFilms Inc., 575 Maryville Centre Drive, St Louis, MO 63141; 800-851-7781; www.llumar.com
2. Graffiti removal Inc., Po Box 2991, La Habra, CA 90632; 909-464-2700; www.vandalshiled.com
4. Or engineer’s approved equal.

B. Product Description: Multi-layered product, 4 mils thick, applied to interior glass surfaces, consisting of from outboard surface to inboard surface:

1. Removable release liner.
2. Pressure sensitive adhesive.
3. Clear, dyed or metalized layers of polyester film.
4. Scratch resistant coating.

C. Colors: Clear.
D. Glazing film accessories
   1. General: Provide products complying with requirements of
      glazing film manufacturer for application indicated, and with a
      proven record of compatibility with surfaces contacted in
      installation.
   2. Adhesive: Pressure sensitive acrylic adhesive system.
   3. Cleaners, Primers, and Sealers: Types recommended by
      glazing film manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer
   present, for compliance with the following:

   1. Manufacturing and installation tolerances, including those for
      size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.
   5. Proceed with installation only after unsatisfactory conditions
      have been corrected.

B. Sacrificial window film

   1. Examine glass and surrounding adjacent surfaces for
      conditions affecting installation.
      a. Report conditions that may adversely affect installation. In report,
         include description of any glass that is broken, chipped,
         cracked, abraded, or damaged in any way.
   2. Proceed with installation only after unsatisfactory conditions
      have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass
   immediately before glazing. Remove coatings not firmly bonded to
   substrates.
B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Sacrificial window film

1. Comply with manufacturer’s written instructions for surface preparation.

2. Immediately before beginning installation of films, clean glass surfaces of substances that could impair glazing film’s bond, including mold, mildew, oil, grease, dirt and other foreign materials.

3. Protect window frames and surrounding conditions from damage during installation.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.
G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.06 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.07 LOCK-STRIP GASKET GLAZING

A. Comply with ASTM C 716 and gasket manufacturer's written instructions. Provide supplementary wet seal and weep system unless otherwise indicated.

3.08 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Final Acceptance. Wash glass as recommended in writing by glass manufacturer.

F. Sacrificial window film

1. Remove excess mounting solution at finished seams, perimeter edges, and adjacent surfaces.

2. Use cleaning methods recommended by glazing film manufacturer.
3. Replace films that cannot be cleaned.

END OF SECTION
SECTION 08872
PROTECTIVE GLAZING FILM

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section consists of the supply and installation of protective glazing film as shown on the drawings and as specified herein.

1.02 REFERENCES

A. ASTM International (ASTM):

2. ASTM D903 – Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
   a. Test 1 Light stability
   b. Test 2 Luminous transmittance
   c. Test 3 Humidity Test 4 Boil
   d. Test 9 Impact (30’ dart drop)
   e. Test 12 Impact (30’ dart drop)
   f. Test 15 Optical deviation and visibility distortion
   g. Test 17 Abrasion resistance (plastics)
h. Test 19 Chemical resistance (non-stressed)
i. Test 24 Flammability of plastic materials
j. Test 28 Resistance to temperature change

1.03 RELATED SECTIONS
A. Division 1 – General Requirements
B. Section 08100 – Metal Doors
C. Section 08520 – Aluminum Windows
D. Section 10416 – Stock Aluminum Bulletin Boards

1.04 SUBMITTALS
A. Provide manufacturer’s catalog cuts and installation details and instructions.

PART 2 PRODUCTS

2.01 PRODUCTS
A. Vandal Shield by Graffiti Removal, Inc. / PO Box 2991 / La Habra, CA 90632 / (714) 901-3993.
B. Or approved equal.

2.02 DESIGN CRITERIA
A. Optically clear, distortion-free sacrificial coating.
B. Three (3) Ply, Construction
   1. Six (6) mil laminate of polyester film with an acrylic coating made up of three (3) 2 mil layers bound with water based adhesive.
      b. Adhesive: Pressure-sensitive acrylic adhesive
      c. Release liner: A 25µ clear silicone coated polyester liner
C. Film shall block 99% of UV rays.
D. If vandalized, the film shall peel off of the glazing surface without damage to the glazing and without leaving any residue or adhesive transfer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install per manufacturer’s instructions and per contract drawings.

B. Install smooth, flat, and without bubbles or creases.

END OF SECTION
SECTION 09000
FINISHES

PART 1  GENERAL

1.01 DESCRIPTION

A. The work of this section consists of various finish systems for steel, and stainless steel as shown on the contract drawings, specified herein.

B. Related Sections

1. Section 05500 – Metal Fabrications

2. Section 05520 – Handrails and Railings

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):


4. ASTM A 386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.

5. ASTM A 780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

6. ASTM A 967 - Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts

7. ASTM B 117 Standard Practice for Operating Salt Spray (Fog) Apparatus

8. ASTM B 766 - Standard Specification for Electrodeposited Coatings of Cadmium


11. ASTM D 792 Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement


16. ASTM D 3363 Standard Test Method for Film Hardness by Pencil Test

17. ASTM D 6386 - Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting

B. AGA - American Galvanizers Association

1.03 SUBMITTALS FOR APPROVAL

A. The Contractor shall provide (6) copies of manufacturer's catalog cuts, product literature and MSDS sheets for powder coat finish system, anodic finish system, galvanizing and paint systems, and manufacturer's color charts.

1.04 QUALITY ASSURANCE

A. Finishers' Qualifications:

1. All galvanizers, painters, powder coaters, and stainless steel passivators and finishers shall have experience in the successful completion of projects employing similar materials, applications, and performance requirements.

B. Manufacturer's Qualifications: All manufacturers shall have experience in the successful completion of projects employing similar materials, applications, and performance requirements.
1.05 WARRANTIES

A. The Contractor shall provide a five-year warranty on all powder coatings and paint systems against finish failure, peeling, and chipping.

PART 2 PRODUCTS

2.01 MATERIALS AND METHODS

A. Stainless Steel

1. All stainless steel shall have a #4 finish, free of heat marks, burn marks, spatter, whiskers, and other blemishes.

2. All stainless steel fabrications shall be chemically cleaned and passivated prior to delivery per ASTM A 380 and A 967.

B. Powder Coating

1. Powder coated items shall be sandblasted to a white finish, and primed with a phosphate inhibiting coating prior to finishing.

2. Finish shall be thermosetting polyester powder two-coat system with minimum overall thickness of 7-15 mil thickness. First coat shall be a zinc rich epoxy powder primer. Second coat shall be colored polyester powder coating, electrostatically applied and oven-cured to a smooth satin finish, per powder manufacturer's instructions. Color shall match Sherwin Williams SW-6993 "Black of Night."

PART 3 EXECUTION

3.01

A. Refer to Section 01100 Summary of Work.

END OF SECTION
THIS PAGE NOT USED
SECTION 09250

GYPSUM BOARD

PART 1  GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Interior gypsum board.
   2. Interior Ceilings

B. Related Sections include the following:
   1. Division 05 Section 09290 “Cold Formed Metal Framing”
   2. Division 06 Section 06100 "Rough Carpentry"
   3. Division 07 Section 07210 "Building Insulation"
   4. Division 09 Section 09900 “Paintings and coatings”

C. Reference:
   1. ASTM International (ASTM):
      e. ASTM C1396 Standard Specification for Gypsum Board.


1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Manufacturer’s specifications and installation instruction for each product specified.

1.04 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

   a. Each level of gypsum board finish indicated for use in exposed locations.

   b. Each texture finish indicated.

2. Apply or install final decoration indicated, including painting and wall coverings, on exposed surfaces for review of mockups.

3. Simulate finished lighting conditions for review of mockups.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

B. Installer Qualifications: Installer of gypsum board is a certified installer with experience installing manufacturer’s products according to manufacturer’s specifications.

C. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
D. Regulatory Requirements: Provide products that comply with the following limits for surface burning characteristics when tested per ASTM E84:

1. Flame spread: 25, maximum.
2. Smoke developed: 450, maximum.

1.05 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer’s written recommendations, whichever are more stringent.

B. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.07 WARRANTY

A. Provide products that offer six months of coverage against in-place exposure damage (delamination, deterioration and decay).

B. Manufacturer’s Standard Warranty: Three years against manufacturing defects.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Georgia-Pacific Gypsum LLC


B. America Gypsum Company

C. BPB America Inc.
D. Or Engineer’s approved equal.

2.02 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.03 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

2.04 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Gypsum Wallboard: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered

C. Gypsum Board, Type X: ASTM C 1396/C 1396M.
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
   1. Thickness: 1/2 inch.
   2. Long Edges: Tapered.

E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
   2. Long Edges: Tapered.
   3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.05 TILE BACKING PANELS
A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer’s standard edges.
   1. Thickness: 1/2 inch

2.06 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
   1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet
   2. Shapes:
      a. Cornerbead.
      b. Bullnose bead.
      c. LC-Bead: J-shaped; exposed long flange receives joint compound.
      d. L-Bead: L-shaped; exposed long flange receives joint compound.
      e. U-Bead: J-shaped; exposed short flange does not receive joint compound.

2.07 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
   1. Interior Gypsum Board: Paper.
   4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
   1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.

4. Finish Coat: For third coat, use setting-type, sandable topping compound.

5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:
   1. Cementitious Backer Units: As recommended by backer unit manufacturer.
   2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

2.08 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
   1. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Thermal Insulation: As specified in Section 072100 "Building Insulation."

PART 3 EXECUTION

3.01 EXAMINATION
A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840 and the manufacturer’s recommendations

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.

2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
H. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.

I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.03 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Wallboard Type: Vertical surfaces unless otherwise indicated.

2. Type X: As indicated on Drawings, where required for fire-resistance-rated assembly

3. Ceiling Type: Ceiling surfaces.

4. Moisture- and Mold-Resistant Type: As indicated on Drawings

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.

2. On partitions/walls, apply gypsum panels vertically (parallel to framing unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

   a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.04 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at [showers, tubs, and where indicated] [locations indicated to receive tile].

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.05 INSTALLING TRIM ACCESSORIES
A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners.
   2. LC-Bead: Use at exposed panel edges
   3. U-Bead: Use at exposed panel edges

3.06 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
   2. Level 2: Panels that are substrate for tile
   3. Level 5: At all exposed surfaces
      a. Primer and its application to surfaces are specified in Section 09900 "Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.07 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION
SECTION 09250
GYPSUM WALL BOARD SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. The work of this section consists of gypsum board, tape and joint compound, trim accessories, and fasteners for complete installations of wall and ceiling systems as shown on the contract drawings and specified herein.

B. The contractor shall be responsible for all aspects of delivery, storage, and installation of all materials in accordance with the manufacturer's written instructions.

1.02 RELATED SECTIONS

A. Division 1 – General Requirements

B. Section 06010 – Lumber and Rough Carpentry

C. Section 09311 – Floor and Wall Tile

D. Section 09900 – Paintings and Coatings

1.03 REFERENCES

A. Gypsum References:

1. ASTM International (ASTM):

   a. ASTM C36 - Gypsum Wallboard

   b. ASTM C79 - Gypsum Sheathing Board

   c. ASTM C442 - Gypsum Backing Board and Core Board

   d. ASTM C475 - Joint Treatment Materials for Gypsum Wallboard Construction

   e. ASTM C514 - Nails for the Application of Gypsum Wallboard

   f. ASTM C557 - Adhesive for Fastening Gypsum Wallboard to Wood Framing

   g. ASTM C630 - Water Resistant Gypsum Backing Board
h. ASTM C645 - Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board

i. ASTM C754 - Installation of Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board

j. ASTM C840 - Application and Finishing of Gypsum Board

k. ASTM C1002 - Steel Drill Screws for the Application of Gypsum Board

l. ASTM E119 - Fire Tests of Building Construction and Materials

2. GA – Gypsum Association

a. GA-201 - Gypsum Board for Walls and Ceilings

b. GA-216 - Recommended Specifications for the Application and Finishing of Gypsum Board

c. GA-600 - Fire Resistance Design Manual

1.04 SUBMITTALS

A. Submit under the provisions of Sections 01300.

B. Gypsum Submittals

1. Submit Product Data on gypsum board, joint tape and accessories.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C840, GA-201, GA-216 and GA-600.

B. Single-Source Responsibility: To ensure proper interface, all drywall furring components shall be produced or supplied by a single manufacturer.

C. All accessory components from other manufacturers shall conform to ASTM standards.

D. Coordination of Work:
1. Coordinate drywall furring work with installers of related work including, but not limited to gypsum board, light fixtures, mechanical systems, and electrical systems.

2. All work above the ceiling line should be completed prior to installing the drywall sheet goods.

PART 2 PRODUCTS

2.01 GYPSUM BOARD MATERIALS

A. Waiting Area Walls and Ceilings
   1. US Gypsum Company
      a. Fiberock Abuse-Resistant Interior Panels, 1/2" thick, tapered edges
   2. Or approved equal

B. Rest Room and Janitor’s Closet Walls and Ceilings
   1. US Gypsum Company
      a. Fiberock Aqua-Tough Interior Panels, 1/2" Thick
   2. Or approved equal

C. Basement Ceiling
   1. US Gypsum Company
      a. Fiberock Aqua-Tough Interior Panels, 5/8" Thick
   2. Or approved equal

D. Accessories
   1. Corner Beads: Metal.
   3. Fasteners: ASTM C1002
PART 3 EXECUTION

3.01 EXAMINATION
A. Verify that site conditions are ready to receive work and dimensions are as indicated on shop drawings.

3.02 INSTALLATION
A. Install gypsum board in accordance with GA-201, GA-216 and manufacturer’s written instructions.
B. Use screws when fastening gypsum board to framing.
C. Place control joints consistent with lines of building spaces.
D. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials as indicated.

3.03 JOINT TREATMENT
A. Tape, fill, and sand exposed joints, edges, fasteners and corners to produce smooth surface ready to receive finishes. Minimum (3) coat application.
B. Feather coats onto adjoining surfaces so that camber is maximum 1/32"

3.04 TOLERANCES
A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8" in 10' in any direction.

END OF SECTION
SECTION 09252
CEMENTITIOUS BACKER BOARD

PART 1 GENERAL

1.01 DESCRIPTION
A. The work of this section consists of cementitious backer board for subflooring as shown on the drawings and specified herein.

B. The contractor shall be responsible for all aspects of delivery, storage and installation of all materials in accordance with the manufacturer's written instructions.

1.02 RELATED SECTIONS
A. Division 1 – General Requirements
B. Section 06010 – Lumber and Rough Carpentry
C. Section 09311 – Floor and Wall Tile

1.03 REFERENCES
A. American National Standards Institute (ANSI):
   1. ANSI 108/A118/A136 - American National Standards for the Installation of Ceramic Tile.
   2. ANSI A108.11 - Installation of Cementitious Backer Units.
   3. ANSI A118.4 - Specifications for Latex Portland Cement Mortar
   4. ANSI A118.9- Cementitous Baker Units.
   5. ANSI A136.1 - Organic Adhesives for Installation of Ceramic Tile

B. ASTM International (ASTM):
   1. ASTM C1288 – Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets

1.04 SUBMITTALS
A. Submit under the provisions of Sections 01300.
B. Submit Product Data
1. Preparation instructions and recommendations
2. Storage and handling requirements and recommendations
3. Installation methods

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store boards flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

1.06 WARRANTY

A. Manufacturer’s twenty (20) year warranty against manufacturing defects.

PART 2 PRODUCTS

2.01 MATERIAL

A. Acceptable Manufacturer

1. James Hardie Building Products, Inc., Mission Viejo, CA

2. Or approved equal.

B. Acceptable Product

1. HardieBacker: ½” nominal cement board

2. Material shall meet the following building code compliance:

   a. Non-asbestos fiber-cement board to comply with ASTM C1288 and ANSI A118.9.

   b. Board shall meet the building code compliance National Evaluation Report No. NER 405.

   c. US Department of Housing and Urban Development Materials Release 1268C.

C. Wood Framing Fasteners

1. 1½” No. 8 by 0.375” HD self-drilling, corrosion resistant ribbed wafer head screws.
PART 3 EXECUTION

3.01 EXAMINATION
A. Do not begin installation until substrates have been properly prepared.

3.02 PREPARATION
A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION
A. Install in accordance with manufacturer’s instructions. Install sheets with 1/8” gap between sheets.
B. Place fasteners 8” on center no closer than 3/8” from board edges and 2” from board corners.
C. Boards shall be placed with a minimum ¼” clearance from the floor surfaces. This gap shall be free of adhesive and grout and filled with a flexible sealant.
D. Joints shall be reinforced with 2” wide, high-strength, coated, alkali-resistant, glass fiber reinforcing tape embedded into the wet mastic or modified thin set mortar and allowed to dry thoroughly.

END OF SECTION
SECTION 09605

CONCRETE LOGOS

PART 1 GENERAL

1.01 Description

A. The work of this section consists of the installation of engraved enameled logos on concrete.

B. The Contractor shall be responsible for all materials, labor, storage and equipment. This shall include but not necessarily be limited to supplying and cutting all stencils, site preparation and installation.

1.02 Submittals

A. The Contractor shall provide (3) copies of the following:
   1. Manufacturer’s product literature for stencil and urethane enamel
   2. MSDS Sheets for all paints, filter, resins and other chemicals to be used
   3. Shop Drawings:
      a. ¼ =1’-0” Layout Plan showing exact installation areas.
      b. Full Scale Production Sample (on paper) of stencil
   4. Large scale detail of material thicknesses on concrete

1.03 Quality Control

A. Upon SEPTA’s request, the Contractor shall submit a list of a minimum of 3 projects using the specified materials that he or she has completed in the last (3) years. Information shall include: project name, square footage, owner contact name, owner’s contact phone number, address and email address.

B. Contractor Qualifications: Installation must be performed by a manufacturer certified contractor with skilled mechanics, having not less than three years of satisfactory experience in the installation of the type of system specified herein. Contractor must have at least three projects of comparable scope and complexity. Installer must be approved, authorized, or licensed to warranty product for a minimum of one year following installation.

1.04 Project Conditions

A. Apply contract between 40 degrees F and 100 degrees F and when forecasted temperature will be above 48 hours following installation.

1.05 Delivery, Storage and Handling

A. Store all materials in accordance with manufacturer’s instructions with seals and intact and legible. Maintain temperatures within the required range. Do not use materials which exceed the manufacturer’s maximum recommended shelf life.
1.06 Warranty

A. The Contractor shall correct, at his or her own expense, any defects in the work including faulty paint, faulty workmanship and/or adhesion failures appearing within one year from the date of installation.

B. Contractor shall repair defective areas by repairing or replacing concrete if a suitable repair is not feasible, and recoating the affected area.

C. In case of a warranty claim, the contractor will have 60 days after being notified by SEPTA to complete the repair work. SEPTA will provide free and unencumbered access to the area during normal work hours for warranty repairs unless such work interferes with the normal operation of SEPTA’s transportation facility.

PART 2 PRODUCTS

2.01 Materials

A. Provide stencil and enamel system that meets the characteristics listed in Section 2.02.

B. Alternate methods for permanently installing logos on concrete, including the application of a heat-applied thermo-plastic system designed for adhesion to concrete, will be evaluated by SEPTA’s project manager for acceptance as an approved equal. Alternative methods must be submitted to SEPTA’s Project Manager prior to the award of the contract. These methods will be evaluated by SEPTA’s Project Manager based on the characteristics listed in section 2.02, and any others that he or she deems necessary.

2.02 Material Properties

A. Materials shall be resistant to foot traffic, de-icing salts and chemicals; and cleaning chemicals.

B. Materials shall be temperature resistant for temperatures between -30 degrees F and 130 degrees

C. System shall be designed and warranted for adhesion to concrete

D. Slip resistance (static coefficient of friction): .5 minimum

E. Minimum change in finished level: 1/8"

F. Edges shall have sharpness and clarity

G. Material shall be proven durable on concrete for 3 years based on prior installations.

2.03 Stencil and Enamel System, Materials
A. Stencil Material:
   1. 3M Sandblast Stencil, Type 520, 520 ETL, 520S or 520T
      a. Manufactured by 3M Industrial Business: Industrial Adhesives and
         Tapes Division, 3M Center, Building 21 – W-10/900 Bush Avenue, St.
         Paul, MN 55144-1000, (800) 362-3550, www.3M.com/industrial
   2. Approved equal sandblast stencil with rubber adhesive and polyester lining,
      meeting the following characteristics:
      a. Liner Thickness: 2-4 mils
      b. Adhesion to Granite, ASTM D3330: 36 oz / inch width
      c. Total Thickness, ASTM D3652: 4.5 mils

B. Urethane enamel
   1. Pittthane Ultra Gloss Urethane Enamels 95-812 Series
      a. Manufactured by PPG Architectural Finishes Inc., One PPG Place,
         Pittsburgh, PA 15272, (800) 441-9695, www.ppghpc.com
   2. Approved equal product meeting the following characteristics:
      a. Taper Abrasion, ASTM D 4060: 94.4 mg
      b. Pencil Hardness, ASTM D 3363: f
      c. Direct Impact, ASTM D2794: 30 inch-lbs
      d. Reverse Impact, ASTM D2794: <5 inch-lbs
      e. Conical Mandrel, ASTM D 522: Pass, No Cracking
      f. Mar Resistance, ASTM D 5178: 800 gms
      g. Initial Gloss at 60 degrees, ASTM 523: 92
      h. Gloss after 1500 hrs, QUV B Bulb, ASTM D 3359: (FMC-2) 3.57
      i. Cross Hatch Adhesion, ASTM D3359: 5B
      j. Dry Time to Touch at 77 degrees F, 50% Rel Humidity: 2 Hours
      k. Dry Time to Handle at 77 degrees F, 50% Rel Humidity: 4.5 Hours
      l. Volume Solids: 70.4% +/- 2%
      m. Weights Solids: 82.7% +/- 2%
      n. Mixed VOC 2.01 lbs/gal MAX
      o. Coverage (theoretical at recommended DFT): 375-572 sq ft / gallon
      p. Color: Black

PART 3 EXECUTION

3.01 Surface Preparation

A. Contractor shall examine surface and clean to required specifications

B. Contractor shall ensure that the surface is free of all laitance, efflorescence,
   chemical containments, grease, oil, old paint or foreign matter. The prepared
   surface must be clean and structurally sound. Shot blasting, scarifying or water
   blasting may be necessary to achieve this proper profile. Acid etching or other
   treatments should be evaluated, and must be approved by SEPTA prior to being
   used.

C. Substrate must be between 40 degrees F and 100 degrees F prior and throughout
   to installation.
3.02 Installation

A. Adhere stencil to warm, clean and dry surface. Remove stencil scrap areas. Allow stencil to relax to minimize shrinkage.

B. Sandblast logo 1/16” to 3/32” deep

C. Mix urethane enamel according to manufacturer’s instructions. Install within manufacturer’s established pot-life

D. Install a minimum of 2 coats to obtain the following dry film thickness:
   1. Wet mils: 2.8-4.3 mils
   2. Dry Mills: 2.0-3.0 mils

E. Allow manufacturer’s required drying time between coats

F. For all coats, do not allow application to bleed outside of stencil

G. Protect surface for a minimum of 6 hours following installation, or as manufacturer’s instructions whichever is longer.

H. Contractor shall be responsible for protecting areas from pedestrian traffic for required set time, by use of temporary barricades or coverings

3.03 Protecting and Cleaning

A. Protect surrounding concrete from sandblasting and urethane enamel

B. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION
SECTION 09653

RESILIENT BASE AND ACCESSORIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Resilient corner molding

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.04 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Coordinate mockups in this Section with mockups specified in other Sections.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.02 VINYL MOLDING ACCESSORY

A. Manufacturer:
   1. Johnsonite
   2. Or approved equal

B. Description: Flexible vinyl corner molding

C. Profile and Dimensions: 1/8" thick x 3/4" x 3/4" and 1/8" thick x 1 1/2 " x 1 1/2 ".

D. Locations: Interior of stair towers at steel enclosure, see contract drawings for locations

E. Colors: match CMU Trendstone plus color Madison

2.03 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
   1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
   1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.03 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.04 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION
THIS PAGE NOT USED
SECTION 09670

SEAMLESS QUARTZ FLOORING

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of all labor, materials equipment and incidentals necessary to provide seamless quartz flooring with an aliphatic urethane protective coating for elevator cab floors.

1.02 RELATED SECTIONS

A. Division 14 – Conveying Systems

1.03 submittals

A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each flooring component required.

B. Samples for Verification: For each flooring system required, 6 inches square, applied to a rigid backing by Installer for this Project.

C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Material Test Reports: For each flooring system, by a qualified testing agency.

E. Maintenance Data: For resinous flooring to include in maintenance manuals

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Engage an installer who is certified in writing by quartz flooring manufacturer as qualified to apply quartz flooring systems indicated.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mockups on 96-inch- square floor area selected by Architect.
a. Include 96-inch length of integral cove base with inside and outside corner.

2. Simulate finished lighting conditions for Architect’s review of mockups.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

5. A pre-installation conference shall be held between Applicator, General Contractor and the Owner to review and clarification of this specification, application procedure, quality control, inspection and acceptance criteria and production schedule.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer’s labels indicating brand name and directions for storage and mixing with other components.

1.06 FIELD CONDITIONS

A. Environmental Limitations: Comply with quartz flooring manufacturer’s written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting quartz flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.

1.07 WARRANTY

A. Provide a written standard warranty from the manufacturer against defects of materials for a period of five (5) years, beginning with date of final acceptance of the project.

PART 2 – PRODUCTS

2.01 manufacturer
A. Basis of Design: Dur-A-Flex, Inc., 95 Goodwin Street, East Hartford, CT 06108, Phone: (860) 528-9838, Fax: (860) 528-2802

B. Or approved equal.

2.02 Seamless Quartz Flooring System


1. System Materials:
   c. The quartz aggregate shall be Dur-A-Flex, Inc. Q-28 colored quartz aggregate.
   e. Topcoat: Dur-A-Flex, Inc. Armor Top resin and hardener, satin finish

2. Patch Materials

B. PRODUCT REQUIREMENTS

1. Primer Dur-A-Glaze #4 WB
   a. Percent Solids 56 %
   b. VOC 2 g/L
   c. Bond Strength to Concrete ASTM D 4541 550 psi, substrates fails
   d. Hardness, ASTM D 3363 3H
   e. Elongation, ASTM D 2370 9 %
   f. Flexibility (1/4: Cylindrical mandrel), ASTM D 1737 Pass

Seamless Quartz Flooring 09670-3
g. Impact Resistance, MIL D-2794 >160

h. Abrasion Resistance, ASTM D 4060, CS 17 wheel, 1,000 g Load 30 mg loss

2. Broadcast, Grout and Topcoat Dur-A-Glaze #4
   a. Percent Solids 100 %
   b. VOC 3.8 g/L
   c. Compressive Strength, ASTM D 695 11,200 psi
   d. Tensile Strength, ASTM D 638 2,100 psi
   e. Flexural Strength, ASTM D 790 5,100 psi
   f. Abrasion Resistance, ASTM D 4060 C-10 Wheel, 1,000 gm load, 1,000 cycles 29 mg loss
   g. Flame Spread/NFPA-101, ASTM E 84 Class A
   h. Impact Resistance MIL D-24613 0.0007 inches, no cracking or delamination
   i. Water Absorption, MIL D-24613 Nil
   j. Potlife @ 70 F 20 minutes

3. Topcoat Armor Top
   a. Percent Solids 95 %
   b. VOC 0 g/L
   c. Tensile Strength, ASTM D 2370 7,000 psi
   d. Adhesion, ASTM 4541 Substrate Failure
   e. Hardness, ASTM D 3363 4H
   f. 600 Gloss ASTM D 523 70
   g. Abrasion Resistance, ASTM D4060 Gloss / Satin
PART 3 – EXECUTION

3.01 EXAMINATION
A. Examine substrates, areas and conditions, with Applicator present, for compliance with requirements for maximum moisture content, installation tolerances and other conditions affecting flooring performance.

1. Verify that substrates and conditions are satisfactory for flooring installation and comply with requirements specified.

3.02 PREPARATION
A. General

1. Concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.

2. Moisture Testing: Perform tests recommended by manufacturer and as follows.

a. Perform anhydrous calcium chloride test ASTM F 1869-98. Application will proceed only when the vapor/moisture emission rates from the slab is less than and not higher than 3 lbs/1,000 sf/24 hrs.

b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

c. If the vapor emission exceeds 75% relative humidity or 3 lbs/1,000 sf/24 hrs then Dur-A-Flex, Inc Dur-A-Glaze MVP Primer moisture mitigation system must be installed prior to resinous flooring installation. Slab-on grade substrates without a vapor barrier may also require the moisture mitigation system.
3. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.

4. Mechanical surface preparation
   a. Shot blast all surfaces to receive flooring system with a mobile steel shot, dust recycling machine (Blastrac or equal). All surface and embedded accumulations of paint, toppings hardened concrete layers, laitance, power trowel finishes and other similar surface characteristics shall be completely removed leaving a bare concrete surface having a minimum profile of CSP 4-5 as described by the International Concrete Repair Institute.
   b. Floor areas inaccessible to the mobile blast machines shall be mechanically abraded to the same degree of cleanliness, soundness and profile using diamond grinders, needle guns, bush hammers, or other suitable equipment.
   c. Where the perimeter of the substrate to be coated is not adjacent to a wall or curb, a minimum 1/4 inch key cut shall be made to properly seat the system, providing a smooth transition between areas. The detail cut shall also apply to drain perimeters and expansion joint edges.
   d. Cracks and joints (non-moving) greater than 1/8 inch wide are to be chiseled or chipped-out and repaired per manufacturer’s recommendations.

5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.03 APPLICATION

A. General

1. The system shall be applied in seven distinct steps as listed below:
   a. Substrate preparation
   b. Priming
   c. First broadcast coat application with first aggregate broadcast
   d. Second broadcast coat with second aggregate broadcast
   e. Grout coat application, sand floor (if required)
f. First topcoat application

g. Second topcoat application

2. Immediately prior to the application of any component of the system, the surface shall be dry and any remaining dust or loose particles shall be removed using a vacuum or clean, dry, oil-free compressed air.

3. The handling, mixing and addition of components shall be performed in a safe manner to achieve the desired results in accordance with the Manufacturer’s recommendations.

4. The system shall follow the contour of the substrate unless pitching or other leveling work has been specified by the Architect.

5. A neat finish with well-defined boundaries and straight edges shall be provided by the Applicator.

B. Primer

1. The primer shall consist of a liquid resin and hardener that is mixed at the ratio of 1 part resin to 4 parts hardener per the manufacturer’s instructions.

2. The primer shall be applied by 1/8 inch notched squeegee and back rolled at the rate of 200 sf/gal to yield a dry film thickness of 4 mils.

C. Broadcast Coat

1. The broadcast coat shall be applied as a double broadcast system as specified herein.

2. The broadcast coat shall be comprised of two components, a resin, and hardener as supplied by the Manufacturer and mixed in the ratio of 2 parts resin to 1 part hardener.

3. The resin shall be added to the hardener and thoroughly mixed by suitably approved mechanical means.

4. The broadcast coat shall be applied over horizontal surfaces using “v” notched squeegee and back rolled at the rate of 90-100 sf/gal.

5. Colored quartz aggregate shall be broadcast to excess into the wet material at the rate of 0.5 lbs/sf.

6. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.
7. Apply a second coat of resin with a coverage rate of 90-100 sf/gal and broadcast aggregate to excess at the rate of 0.5 lbs/sf.

8. Allow material to fully cure. Vacuum, sweep and/or blow to remove all loose aggregate.

D. Grout Coat

1. The grout coat shall be comprised of a liquid resin and a liquid hardener that is mixed in the ratio of 1 part hardener to 2 parts resin and installed per the manufacturer’s recommendations.

2. The grout coat shall be squeegee applied and back rolled with a coverage rate of 90-100 sf/gal.

E. First Topcoat

1. The topcoat shall be comprised of a liquid resin and a liquid hardener that is mixed in the ratio of 1 part hardener to 2 parts resin and installed per the manufacturer’s recommendations.

2. The topcoat shall be squeegee applied and back rolled with a coverage rate of 200 sf/gal.

F. Second Topcoat

1. The topcoat of Armor Top shall be roller applied at the rate of 500 sf/gal to yield a dry film thickness of 3 mils.

2. The topcoat shall be comprised of a liquid resin, hardener and grit that is mixed per the manufacturer’s instructions.

3. The finish floor will have a nominal thickness of 1/8 inch.

3.04 FIELD QUALITY CONTROL

A. Tests, Inspection

1. The following tests shall be conducted by the Applicator:

   a. Temperature: Air, substrate temperatures and, if applicable, dew point.

   b. Coverage Rates: Rates for all layers shall be monitored by checking quantity of material used against the area covered.

3.05 CLEANING AND PROTECTION
A. Cure flooring material in compliance with manufacturer’s directions, taking care to prevent their contamination during stages of application and prior to completion of the curing process.

B. Remove masking. Perform detail cleaning at floor termination, to leave cleanable surface for subsequent work of other sections.

END OF SECTION
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SECTION 09900
PAINTINGS AND COATINGS

PART 1 GENERAL

1.01 SUMMARY

A. DESCRIPTION: Provide painting, as shown and scheduled per Contract Drawings; including, but not limited to:

1. Painting and surface preparation for interior and exterior finished surfaces

2. Priming of substrates.

3. Finishing of isolated new woodwork.

1.02 SUBMITTALS

A. SAMPLES:

1. General: Submit specified colors for each surface-finishing product.

2. Field Samples:

a. General: In place, on material scheduled to be finished, illustrating coating color, texture and finish. Locate where directed; accepted sample may remain as part of the Work.

b. Size: One (1) entire unit as scheduled to be finished

B. PRODUCT DATA: Submit manufacturer's specifications, data, and installation instructions for review.

C. CERTIFICATES: Submit statement of VOC compliance with local regulations.

D. CLOSEOUT:

1. Extra Stock: Deliver one percent (1%) or a minimum of two (2) gallons of each color, type, and surface texture of paint installed. Label each container with color, type, texture, and room locations.

2. Guarantee:
a. General: Provide, in required form, for a period of five (5) years from date of final acceptance

b. Criteria: Color and finish appearance shall remain unchanged throughout entire guarantee period.

1.03 QUALITY ASSURANCE

A. GENERAL: Refer to Section 01400 - CONTRACTOR’S QUALITY ASSURANCE SYSTEM.

B. REFERENCE STANDARDS:


C. QUALIFICATIONS:

1. Applicator: Specializing in performing the work of this Section with documented experience.

2. Volatile Organic Compounds (VOC): Use only products in compliance with VOC content limits required by state and local regulations.

1.04 DELIVERY, STORAGE, AND HANDLING

A. DELIVERY:

1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacturer’s unopened packages and bearing manufacturer’s label.

B. STORAGE:

1. General: Store materials in a dry and properly ventilated separate structure not less than 50'-0" from any other structure on the site. Adequately protect from damage and exposure to the elements.
2. Temperature: Maintain minimum of 45 degrees F and a maximum of 90 degrees F.

3. Fire Prevention: Take necessary precautions to prevent fire; remove paint-soiled rags and waste from building each day or store in metal containers with covers in the paint storage structure.

PART 2 PRODUCTS

2.01 MATERIALS

A. MANUFACTURER:

1. Acceptable Manufacturers:
   a. Carboline Co.
   b. Sherwin Williams
   c. Benjamin Moore
   d. Or approved equal.

2. Container Label: Identify with manufacturer's name, and include description of type of paint, brand name, lot number, and brand code and color designation.

B. GENERAL: Provide ready mixed products, except field catalyzed coatings. Provide accessory materials such as linseed oil, shellac, thinners, cleaners, and other materials not specifically indicated but required to achieve finishes specified.

1. Use only one lot of paint for any individual element to be painted. Do not mix lots of paint.

2. Or approved equal

C. Galvanized & Painted Duplex Systems

1. Fabrications shall be hot-dip galvanized after fabrication per ASTM A 123 and ASTM D 6386. Provide a minimum of 2.00 oz/sf galvanized coating. Surfaces shall be smooth and free of drips and splatters.

2. Galvanizer shall carefully minimize drips and splatters to provide a smooth, consistent surface to receive paint.
3. All assemblies shall be shop-painted after galvanizing. Galvanizer shall coordinate with paint manufacturer in order to properly galvanize and prepare galvanized surfaces to ensure a compatible duplex system. Prepare galvanized surfaces to be painted in accordance with AGA standards and paint manufacturer's written recommendations.

4. Painting shall occur soon after galvanization within the time-frames outlined in ASTM D 6386.

5. Galvanized assemblies shall be painted and therefore shall not be quenched.

6. Do not paint surfaces in direct contact with concrete.

D. Exterior

1. Galvanized structural steel including, but not limited to; bridge steel and platform canopy steel
   a. Spot primer - (3-pak) Carbozinc 859 (3-5 mils spot coat)
   b. Primer - Epoxy Primer Carboguard 983 SG, tinted to match finished coat (3-6 mils full coat)
   c. Finish Coat – Carboxane 2000 (3-7 mils full coat)

2. A. Galvanized Railings and Frames
   a. (1) coat Corothane I - MIO Aluminum Primer B65S14
   b. (2) coats High Solids Polyurethane B65-300

3. B. Railings – Spot Primed Areas and Finish
   a. (1) coat Corothane I - MIO Aluminum Primer B65S14
   b. (2) coats High Solids Polyurethane B65-300

4. Railing Base Plate - Spot Prime Soldered Areas
   a. (1) coat Corothane I Galvapac Zinc Primer B65G11
   b. (1) coat Corothane I - MIO Aluminum Primer B65S14
   c. (2) coats High Solids Polyurethane B65-300

5. Composite Trim
   a. (1) coat Pro-Cryl Universal Gray Primer B66-310
   b. (2) coats DTM Acrylic Semi Gloss B66-200

6. Miscellaneous Metal trim
   a. (1) coat Corothane I - MIO Aluminum Primer B65S14
   b. (2) coats High Solids Polyurethane B65-300

7. Bollards
   a. (1) coat Kem Bond Primer B50AZ8
   b. (2) coats Industrial Enamel HS Gloss B54 series
   c. Color: Safety Yellow

Paintings and Coatings 09900-4
8. Various Slightly Rusted Substrates – Interior or Exterior  
   a. (1) coat Macropoxy 646 Fast Cure Epoxy B58-600  
   b. (2) coats Industrial Enamel HS Gloss B54 series  
   c. or  
   d. (2) coats High Solids Polyurethane B65-300

E. Galvanized Metal Note:

1. Field Work - A solvent wash using Hurrisafe on non-weathered galvanized, prior to the primer coat is recommended.
2. Shop Work - Clean and Etch as manufactured by Sherwin Williams on newly galvanized clean steel or a brush blast on galvanized steel that needs some cleaning of scale before priming is recommended.

F. Interior

1. Hollow metal doors and metal frames  
   a. (1) coat Kem Bond Primer B50AZ8  
   b. (2) coats High Solids Polyurethane B65-300

2. Wooden doors and frames  
   a. (2) coats Industrial Enamel HS Gloss B54 Series

3. Drywall Ceilings  
   a. (2) coats ProMar 200 Latex Flat B30W400

4. Walls  
   a. CMU or Concrete Block  
      1) (1) coat PrepRite Block Filler B25W25  
      2) (2) coats ProMar 200 Latex Semi Gloss B31W200  
   b. Drywall  
      1) (1) coat PrepRite 200 Primer B28W200  
      2) (2) coats ProMar 200 Latex Semi Gloss B31W200

5. Stair Trim  
   a. (1) coat Kem Bond Primer B50 Series  
   b. (2) coats Industrial Enamel HS B54

6. Concrete Floors  
   a. (1) coat Armorseal Treadplex Primer B90W110  
   b. (2) coats Armorseal Urethane 1K B65 Series
7. Technical mix-down color documentation specific to SEPTA’s Standard Colors may be obtained by contacting the Sherwin Williams’ Philadelphia Store located on Delaware Avenue.

G. SEPTA Regional Rail Standard Colors:

1. Urban Bronze – Canopy Framing Steel, Canopy Columns, and overpass framing,
2. Black as Night – Windscreen Steel Frames, Sign Frames, Light Poles, Estate Fencing, Benches, Trash Receptacles, Bike Hoops, Decorative Bollards and News Box Corals
3. Bainbridge Green – Guard and Handrails
4. Clear Anodized Aluminum – Glass Block Grid

H. MISCELLANEOUS CLEANING AND REFINISHING MATERIALS:

1. Fine grade Scotch-Brite pads (white and/or green type, manufactured by 3M Co, St Paul MN, or approved equal.
2. Very fine steel wool, clean and free of contaminants and corrosion.
3. Clean, soft, lintless, cotton rags.

I. SOLVENT CLEANERS AND THINNERS:

1. Xylene: Commercial manufacture.
2. White Spirit: Commercial manufacture.
3. Odorless Lacquer Thinner: Commercial manufacture.
4. Denatured Alcohol: Commercial manufacture.
5. Or approved equal.

2.02 MIXING

A. GENERAL: Mix paints at the factory; do not alter or reduce materials except as directed by manufacturer.

B. COLORS: See schedule.

C. MILDEW RESISTANCE: Add fungicidal agent to paint per manufacturer's recommendations. Add agent at the factory; clearly indicate on label that paint is mildew resistant.
PART 3 EXECUTION

3.01 PREPARATION

A. ENVIRONMENTAL REQUIREMENTS:

1. General: Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the manufacturer.

2. Temperature:
   a. General: Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the manufacturer.
   b. Exterior Paints: 40 degrees F minimum during and for 48 hours after application; do not apply when temperature is over 90 degrees F, except in protected or shaded areas.
   c. Interior Paints: 50 degrees F for minimum of 48 hours before, during, and for 48 hours after application.

3. Ventilation: Provide adequate ventilation of all interior spaces during application and curing of all painting products.

4. Lighting Level: Provide minimum 80 foot candles measured at mid-height of room. At exterior, measured at mid height of element to be painted.

B. EXAMINATION:

1. General: Examine conditions of surfaces in place before beginning work; report defects.

2. Shop Applied Primer: Test for compatibility with subsequent cover materials

3. Moisture Content: Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

4. Acceptance: Application of first coat of painting process constitutes acceptance of surface

C. PROTECTION: Protect adjacent surfaces not scheduled for paint finish from damage resulting from painting operations.
D. STEEL/METALS SURFACE PREPARATION:

1. Blast cleaning of faying surfaces shall be performed in accordance with SSPC-SP10, Near-white Blast Cleaning.

2. Blast cleaning all other steel shall be performed in accordance with SSPC-SP6, Commercial Blast Cleaning.

3. Oil, grease, salts, or other surface contaminations must first be removed by the methods outlined in SSPC SP 1.

4. Dust conditions at the station site shall be anticipated, and such dust as may collect shall be removed before touch-up paint is applied.

5. All flux, spatter, slag, or laminations from welding or other sharp projections shall be ground smooth prior to blast cleaning.

6. All areas blast cleaned on any day shall be coated on the same day. Any such areas not coated that are exposed overnight shall be lightly “whip-blasted” to remove any visible or invisible rust that may have formed.

7. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing. Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface conditions. Use Shellac to seal marks, which may bleed through surface finishes.

8. Impervious Surfaces: Remove mildew by scrubbing with solution of trisodium phosphate and bleach. Rinse with clean water and allow surface to dry.

9. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent to remove all oil, grease and other foreign matter. Prime bare steel surfaces.

10. Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.02 APPLICATION

A. GENERAL: Install in conformance with referenced standards, manufacturer's written directions, as shown, and as specified.
B. PERFORMANCE:

1. General: Apply each coat to uniform finish, slightly darker than preceding coat unless otherwise approved. Sand surfaces lightly between coats to achieve required finish. Vacuum clean surfaces free of loose particles; use tack cloth just prior to applying next coat. Allow applied coat to dry before next coat is applied.

3.03 CLEANING

A. GENERAL: Upon completion, remove masking materials, reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing, and thoroughly clean all exposed surfaces per manufacturer’s instructions. Keep premises free from accumulation of waste and rubbish. At the completion of work remove surplus materials, rubbish, and debris.

B. TOUCH-UP: After detailed inspection of paint work, touch up or refinish abraded, stained, or otherwise disfigured work, as required by the Engineer.

C. CLEANING: Remove containers, rags, and debris from the site; observe special care in control or disposal of flammable materials.

END OF SECTION
SECTION 10200
LOUVERS AND VENTS

PART 1 GENERAL

1.01 SECTION INCLUDES
A. Requirements for metal regular and louvers.

1.02 RELATED SECTIONS
A. Section 07600 – Flashing and Sheet Metal.
B. Section 07900 – Joint Sealers.
C. Section 01300 – Submittals.

1.03 STANDARDS AND REGULATIONS
A. Building Code of the State of Pennsylvania
B. Energy Conservation Construction Code of Pennsylvania
C. Structural Requirements: Design louvers to safely withstand dead load and live loads prescribed by governing building code.

1.04 RESTRICTIONS AND QUALITY CONTROL
A. Manufacturer Qualifications: A company designing, manufacturing, and installing products of this section which have performed in a satisfactory manner under comparable conditions.
B. Performance: Where louver performance requirements are specified, determine compliance in accordance with AMCA Standard 500.

1.05 SUBMITTALS
A. Shop drawings showing material, finish, size of members, method of assembly, and installation and anchorage details. Show elevations, field measurements (if applicable), reinforcement, anchorages, and expansion provisions.
B. Samples for Verification of Finishes: For each type and color of finish, submit 12-inch-long sections of extrusions or formed sections and 6-inch-square sheets. Submit at least 2 pieces for each color showing full range of color variations.
C. All submittals are to be in accordance with Section 01300 – Submittals.
1.06 WARRANTY

A. Warranty and Maintenance Agreement: Upon completion of the Work and as a condition of its acceptance, deliver to SEPTA two copies of the following "Warranty and Maintenance Agreement", signed by the Manufacturer and Installer of the Work of this Section.

1. Upon execution of this document by SEPTA, the undersigned hereby propose and agree, for a period of two years after Substantial Completion of the Work, to make immediate repairs as required to stop leaks or correct defects in the Work of this Section. Said repairs shall be made within 24 hours of the receipt of a notice from SEPTA by telephone, telegram or letter. The undersigned further agree to make such repairs without reference to or consideration of the cause or nature of such leaks or defects.

2. The manufacturer shall warrant for a period of two years that the wall system, including louvers and copings, materials and their finishes will be free from defects. The wall systems contractor shall warrant for a period of two years that the installation workmanship will be free from defects in materials and installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 01 Quality Requirements Section 01401.

B. Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer’s original unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

E. Store materials and accessories off ground, under cover, and protected from weather and construction activities.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wall Louvers:
1. Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
   a. Nystrom, Airline louvers.
   b. Airolite Company.
   c. American Warming and Ventilating.
   d. CESCO Products.
   e. 
   f. Industrial Louvers, Inc.
   g. Louvers & Dampers, Inc.
   h. Ruskin Manufacturing Division/Tomkins Industries, Inc.
   i. Or approved equal

B. Door Louvers:
   1. Products of the following manufacturers, provided they comply with requirements of the contract documents, will be among those considered acceptable:
      b. All-Lite Metal Company.
      c. Construction Specialties, Inc.
      d. Reliable Products/Hart & Cooley, Inc.
      e. Or approved equal

2.02 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T5 or T-52 with temper recommended by louver manufacturer for required structural properties and to produce proper finish.

B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer to produce required finish.
C. Fasteners: Of same basic metal and alloy as fastened metal or 300 series stainless steel, unless otherwise indicated. Do not use metals that are corrosive or incompatible with joined materials.

1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat-head screws for exposed fasteners, unless otherwise indicated.
3. For aluminum members: Aluminum, stainless steel, or galvanized steel.
4. For steel or galvanized steel members: Stainless steel or galvanized steel.
5. For stainless steel members: Stainless steel.
6. Finish exposed-to-view fastener heads to match adjacent surface.

D. Anchors and Inserts: Of type, size, and material required for type of loading and installation indicated. Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

E. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.03 LOUVERS

A. Regular drainable louvers. Provide louvers profiles as indicated on architectural drawings.

1. Louver assembly shall be 2" deep with continuous blade. Blade and framing component shall be a minimum of 0.081 thick. Unused portions shall be blanked off with 0.050 aluminum sheet. Provide pan flashing made of the specified aluminum materials where indicated or required for drainage to the exterior and to prevent water entry at the sill.

B. Screens: Removable type; provide screens for indicated exterior louvers.

1. Frame: Fabricate from same material used for louver. Miter and reinforce frame corners.

   a. Fabricate frame from extruded or formed metal. Provide insert or driven spline for mesh attachment. Frame must be capable of being rewired.
2. Insect screen mesh:

3. Position screen on inner louver face; attach using machine screws located 3 inches from corner and 12 inches on center between corners.

2.04 DOOR LOUVERS


1. Fabricate louvers and integral frame of extruded aluminum, minimum 0.050 inch thick.

2. Frame style: Mitered trim frame, with welded corners; separate inner frame adjustable for door thickness and secured by countersunk screws.

3. Insect screen: Provide 14 by 18 mesh aluminum wire screen. Provide rewirable spliced frame or channels in louver frame to receive screen.


2.05 FABRICATION, GENERAL

A. Fixed type. Drainable Framing System. Head, sill and jamb sections shall have formed caulking slots to retain caulking. Head sections shall have exterior drip lip, sill sections and integral water stops. Furnish louvers with sill extension or separate sill.

1. Provide clearance or recesses as required to accommodate sealant between louver and adjacent construction.

B. Structural Framing System: Extruded aluminum framing system including heads, sills, jambs, intermediate horizontals and interlocking mullions.

1. Structural Performance: Fabricate louver system to withstand the effects of loads and stresses from wind and normal thermal movement without experiencing permanent deformation of components including blades, frames and supports; noise or metal fatigue caused by blade rattle or flutter; or permanent damage to fasteners and anchors.

   a. Wind Load: Uniform pressure (velocity pressure) of 60 LBS/SF.

   b. Temperature Change (Range): 100˚ F.
C. Make frame size 1/2-inch smaller than openings. Blades shall be stormproof and weather resistant type.

D. Louvers shall be equipped with bird screens and made to withstand a wind load of not less than 30 PSF. Provide 1/2-inch square mesh, 14 or 16-gage screens. Mount screens in removable, rewirable frames of same material and finish as the louvers. Prime and paint screens in colors selected by the Engineer.

E. Wall louvers shall bear the AMCA certified ratings program seal for air performance and water penetration in accordance with AMCA 500 and AMCA 511. The rating shall show a water penetration of 0.20 ounces or less per square foot of free area at a free velocity of 800 feet per minute.

F. The louver system shall accommodate various performance criteria including pressure drop requirements, CFM requirements, static pressure drop, water infiltration, free area, and intake/exhaust velocities, etc. while maintaining a consistent exterior architectural line appearance. Louver blade spacing at all elevations and buildings shall be consistent regardless of these varying performance criteria. Provide louver profiles as indicated or where shown on architectural drawings.

G. Provide shop-welded joints between framing components, and between framing components and fixed louver blades, unless otherwise indicated or where field assembly is unavoidable.

2.06 FINISHES

A. KYNAR500

B. Factory Prime Finish: Chemically clean and etch metal and apply at least one coat of manufacturer’s standard corrosion-inhibitive thermosetting (baked) primer.

C. Color: As selected by the Architect/Engineer from manufacturer’s standard colors

2.07 BLANK-OFF PANELS

A. Fabricate blank-off panels for exterior louvers from materials to comply with the following requirements:

1. Finish: Match finish applied to louver with respect to coating type, except for color, which shall be black

2. Attach blank-off panels to back of louver frames with clips.
B. Insulated, Blank-Off Panels: Laminated metal-faced panels consisting of insulating core surfaced on back and front with aluminum sheets.

PART 3  EXECUTION

3.01  EXAMINATION

A. Verify that substrates and openings to receive louvers are rigidly set, at proper lines and elevation, properly sized, and ready to receive louvers.

B. Do not proceed with installation until conditions detrimental to proper installation have been corrected.

3.02  PREPARATION

A. Transmit submittals required by this Section.

B. Coat contact surfaces of dissimilar metals with one or more coats of bituminous paint.

1. The following metals are not considered dissimilar: Aluminum, stainless steel, and zinc.

C. Apply one 15-mil dry film thickness coat of bituminous isolation coating to metal surfaces, other than galvanized steel, which will be in contact with cementitious materials.

3.03  INSTALLATION

A. Locate and place louver units plumb, level, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather tight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.

E. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in the field to the shop, make required alterations, and refinish entire unit, or provide new units.
F. Protect galvanized- and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

G. Install concealed gaskets, flashings, joint fillers, and insulation, as louver installation progresses, to make louver joints weather tight.

H. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items that cannot be refinished in field to the shop, make required alterations and refinish entire unit, or provide new units.

3.04 CLEANING

A. Remove protective material from pre-finished surfaces immediately after installation.

B. Wash exposed surfaces using mild detergent; thoroughly clean inside corners.

C. Remove excess sealant by moderate use of mineral spirits or other solvent recommended by sealant manufacturer.

D. Touch up marred or abraded areas of finished elements. If satisfactory touch-up cannot be accomplished, remove and replace element.

END OF SECTION
SECTION 10240
GRILLS AND SCREENS

PART 1      GENERAL

1.01    SECTION INCLUDES

A. Wire Mesh Partitions, installed elevator shaft ways as indicated in the contract documents.

1.02    SUBMITTALS

A. Submit under provisions of Division 1.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Detailed specification of construction and fabrication.
   2. Manufacturer's installation instructions.
   3. Preparation instructions and recommendations.
   4. Storage and handling requirements and recommendations.

C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
   1. Provide location template drawings for items supported or anchored to permanent construction.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Keys: Submit keys for door locks to Owner at Substantial Completion of the project.

1.03    QUALITY ASSURANCE

A. Design Requirements:
1. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.

2. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

1.05 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.06 WARRANTY

A. Manufacturer will supply a written one year warranty on all products.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer:


2. SpaceGuard Products, Seymour, IN

3. Wire Crafts LLC. Louisville, KY

4. Or approved Equal

2.02 PRODUCT

A. Fabrication:

1. Wire Mesh: #10 W&M Gauge .130 inch, triple crimped bright basic wire 1-1/2 inches diamond mesh pattern.

2. Horizontal Frames: 1 inch by 1/2 inch x 1/8 inch steel channels. Series of holes for through bolting of top cap bar.

4. Center reinforcement bar: Two 1 inch by 3/8 inch by 1/8 inch steel channels or 3/4 inch by 3/8 inch by 1/8 inch steel channels riveted together through mesh 42 inches above finished floor on 7 feet, 8 feet, and 9 feet high panels. Four channels are used on 10 feet and 12 feet high panels.

5. Panels: Consisting of the above horizontal and vertical members mortise and tenon at corners with diamond mesh securely clinched to frames. Center reinforcement bars are attached.

6. Accessories:
   a. Wall Clips: 3/4 inch wide by 1/8 inch thick cold rolled steel; formed and punched for securing to wall.

7. Hardware: 1/4 inch dia. hex head bolts and nuts for all panel to panel, panel to door, and panel/door to post connections. Field bracing, floor and wall anchors by erector. Minimum 18” o.c.

8. Finish: Two stage Phosphate wash with a standard 2 mil Polyester Powder Coat finish
   a. Color: Black as night, SEPTA standard regional rail color.

2.03 FABRICATION

A. Fabricate assemblies of framed sections; to sizes and profiles required; with framing members fitted, reinforced and braced to suit design requirements.

B. Fit and assemble in largest practical sections for delivery to Project Site, ready for installation.

C. Fabricate items with joints tightly fitted and secured.

D. Grind exposed welds smooth and flush with adjacent finish surface. Ease exposed edges to small uniform radius.

E. Make exposed joints flush and hairline.
F. Provide components required for anchorage. Fabricate anchorage and related components of same material and finish as framing members.

2.04 FINISH

A. Clean surfaces of rust, scale, grease, and foreign matter before finishing. Clean material using a two-stage phosphate wash system immediately prior to finishing.

B. Prefinished Surfaces: Wire partition manufacturer's polyester powder finishing system.

1. Finish colors of partitions and accessories: black as night, SEPTA standard regional rail color

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion.

1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's recommendations.

B. Install partitions plumb and level, accurately fitted, properly aligned, securely fastened, and free from distortion or detects.

C. Install field bracing as necessary (not furnished by mesh partition manufacturer) to provide rigid, secure installation.

3.03 TOLERANCES

A. Maximum Variation from Plumb or Level: 1/4 inch in total partition height.

B. Maximum Misalignment from True Position: 1/4 inch

3.04 ADJUSTING

A. Adjust moving components for smooth operation without binding.
B. Adjust locks to provide smooth and secure operation.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION
SECTION 10400
IDENTIFYING DEVICES

PART 1    GENERAL

1.01 SUMMARY

A. DESCRIPTION: Provide all identifying device work as indicated on the Contract Drawings and as specified herein, including, but not limited to, the following:

1. Aluminum Signs.
2. Tactile and Braille Signs

1.02 WORK INCLUDED

A. Labor, materials, equipment, and services necessary for the fabrication, delivery, and installation of signage as described in the detail drawings.

B. Refer to the signage schedule for a complete list of sign types and quantities.

C. Signs listed should match those indicated on sign location plans. Contractor shall notify owner of any discrepancies in sign quantities by doing take-offs before manufacturing signs.

D. For all signs, all fasteners, support structures required for installation.

1.03 RELATED WORK

A. General carpentry and painting requirements: all work to be done in a professional manner and to the highest trade standards.

B. Use OSHA safety requirements if necessary for pedestrian or vehicular safety.

1.04 REGULATORY REQUIREMENTS

A. Observe applicable codes, sign ordinances, and ADA guidelines for handicapped and fire / life safety signing.

1.05 SUBMITTALS

A. GENERAL: Refer to Section 01300 SUBMITTALS.
B. Submit a complete list of all materials proposed to be furnished and installed under this Section.

C. SHOP DRAWINGS:

1. Submit four (4) sets of shop drawings as outlined below.

2. Provide detailed Shop Drawings including plans, elevations, sections, large scale details of sign wording and lettering layout, fabrications, mounting, bracketing details, installation details, and key plans for installation. Show anchorages and accessory items. Provide mounting templates.

3. Show fabrication and installation details, including all sign components such as extrusions, brackets, bracing, hardware, internal framing, foundations, etc.

4. Provide engineering data to confirm viability of signs and supports, including structural stability of all signs, fasteners, and foundation design.

5. For all sign types, structural details must be reviewed and stamped by a certified Structural Engineer, ensuring structural integrity and safety.

6. Sign Schedule including message copy for every sign, by sign number.
   a. Sign messages shall be cross-referenced to the appropriate typical layout and the mounting details.
   b. Sign number, quantity, panel dimension, copy height, graphics, artwork, copy color, background color, and mounting condition shall be noted for each sign.

7. Provide a colored line for each sign, after approval of shop drawings and prior to fabrication.
   a. Colored line shall be exact replicas of sign layouts.
   b. Colored line shall be keyed to the approved sign schedule.
   c. Secure Septa approval prior to fabrication.

D. SAMPLES:

1. Submit two (2) of each sample required.
2. Owner reserves the right to reject any samples that do not satisfy the construction, finish, or color requirements. Submit additional samples as required to obtain final approval.

3. Samples shall be labeled on the back, designating item number, name of manufacturer, sign type, and location.

4. Include the following type specimens in shop drawings:
   a. Alphabet of each typestyle required by the contract documents; upper and lower case, with numerals, punctuation, and accents.
   b. Complete a typical sign message of each sign type to demonstrate proper interletter, interword, and inter-line spacing.
   c. Each material required for fabrication of each sign type with finishes as specified, including extrusions and hardware.
   d. Color samples (minimum size 4 X 4 inches) of each color specified.
   e. Samples should represent extreme variations in color and texture that might occur during fabrication.
   f. Sample materials, fasteners, hardware, and mounting hardware sufficient to get clear ideas of how signs are fabricated, made changeable, and installed.

5. Accompanying the material list, submit a sample of each sign material illustrating the actual finish obtained with complete graphics.

6. Submit sample basketry design for typical mounting surfaces wall, pendent, column, etc. (See signage schedule for complete listing.) Also submit a panel sample with frame on two sides for each proposed thickness combination.

E. Maintenance Data

1. Submit two (2) copies of each manufacturer’s recommendations for maintenance of all items.

2. The instructions shall cover cleaning, repair, repainting, and maintenance of signs, including data on cleaning solutions or methods of application which should be avoided.
1.06 QUALITY ASSURANCE

A. General: Refer to Section 01401 Quality Requirements – General Contract

B. Submit two (2) copies of credentials for any subcontractor selected to execute any portion of this contract, including personnel qualifications, company references, and equipment being employed.

C. REFERENCES:

1. American National Standards Institute (ANSI) A117.1

2. National Association of Architectural Metal Manufactures (NAAMM)

3. Americans with Disabilities Act Architectural Guidelines (ADAAG)

   a. ASTM B221 - aluminum-alloy extruded bars, rods, wire, shapes, and tubes.
   b. ASTM D822 - light and water exposure apparatus (carbon-arc type) for testing paint, varnish, lacquer, and related products.
   c. ASTM E84 - surface burning characteristics of building materials.
   d. B209-86 Aluminum and Aluminum-Alloy Sheet and Plate
   e. B211-85 Aluminum-Alloy Bars, Rods, and Wire

5. Aluminum Welding Society (AWS)
   a. D1.2-83 Structural Welding Code-Aluminum

6. Aluminum Association (AA)
   a. ASD-1 Aluminum Standards and Data, 1979

7. DAF-45 Design System for Aluminum Finishes, 1976

a. FS L-P-391 - plastic sheet, rods and tubing, rigid, cast, materials.

b. FS L-P-387 - plastic sheet, laminated, thermosetting.

c. FF-92B (1) Screw, Machine, Slotted, Cross Recessed or Hexagon Head.

d. TT-645a Primer, Paint, Zinc-Chromatic, Alkyd-Type.

D. FABRICATIONS: For the actual fabrication of the Station Signage, use only mechanics that are thoroughly trained and experience in skills required for the manufacture and fabrication of the units.

1. In acceptance or rejection of the manufactured units, no allowance will be made for lack of skill on the part of the fabricator/manufacturer.

2. The materials must be in full compliance with Contract Documents and approved Shop Drawings.

E. TOLERANCES:

1. Sign Panels and Extrusions:
   a. The Contractor shall note on the shop drawings all fabrication tolerances including, but not limited to: plumb, thickness, length, width, squareness, camber, and flatness.
   b. Signs shall be free of defects including, but not limited to: buckles, dents, wraps, wrinkles, and burrs.
   c. All extrusions for a given shape shall be fabricated from dies of identical cross section dimensions.

2. Messages:
   a. Messages Location: +/-1/16 inch from the location shown
   b. Line to Line: +/-1/32 inch between each line and +/-1/16 inch over the entire message. Letter to Letter or Symbol (horizontally and vertically) +/-1/32 inch between each letter of symbol and +/-1/16 inch over and entire line.
3. Where multiple panels adjoin, the face and edges shall be milled to a tolerance of a +1/32 inch or –1/32 inch from a straight plane, so that when two adjoining panels are assembled, no gap over 1/16 inch shall be visible between panels.

4. Design components to allow for expansion and contraction for temperatures ranging between –20 degrees F and +100 degrees F, without causing bucking, opening of joints other than control joints, or overstressing of welds and fasteners.

5. Comply with AWS D1.2 for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded joints of all welding flux and dress on all exposed and contact surfaces.

6. Mill joints to a tight, hairline fit. Cope or miter corner joints.

F. LOADING: The unit must withstand a wind load of 20#/SF and horizontal/vertical loads of 250# at top center of the sign with a maximum deflection of 1/360 of sign length. Calculations are to be submitted for SEPTA review.

G. MOUNTING: The Contractor shall have all mounting and fabrication details and calculations designed and stamped as approved by a Professional Engineer (PE) licensed in the State of Pennsylvania

1.07 PRODUCTION PROTOTYPE

A. PROTOTYPE: Provide a production prototype for approval at the place of fabrication. The unit will be reviewed by the Engineer and corrections made. This unit will be used as a model for the line production and will be considered and actual unit to be placed on a site, not a mock up, if acceptable to the Engineer.

1.08 PRODUCT HANDLING

A. PROTECTION: Use all means necessary to protect the signs prior to delivery. The pre-assembled units are to be shipped in protective crating and palletized. Each sign package is to bear the identification as noted on the sign schedule.

B. PACKAGING: Each sign will come individually shrink-wrapped complete with its own bracket and attachment hardware.

C. REPLACEMENTS: The Engineer’s sole discretion as to whether replacement or repair will be the procedure for damaged units.
1.09   SIGNAGE DESIGN AND DETAIL STANDARDS

A. All signage shall comply with the current version of the Septa Standard Manual; the messages indicated on the Contract Drawings are illustrative in nature. The Contractor shall become familiar with full range of messages provided. Signage messages for each sign will be provided by SEPTA.

1.07   DELIVERY, STORAGE, AND HANDLING

A. General: Comply with Division 01 Quality Requirements Section 01401.

B. Comply with manufacturer’s ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer’s original unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

E. Store materials and accessories off ground, under cover, and protected from weather and construction activities.

F. For any attic stock ordered, package separately or in like groups labeled as to contents. Include installation hardware, adhesives, and installation instructions; include a reasonable array of alternate adhesives, fasteners, or materials to be able to respond effectively to varying field conditions.

1.10   INSPECTION

A. Materials, colors, and fabricated or partially fabricated items shall be available for inspection at the factory or elsewhere, by the owner or designer during the process of manufacture and until final delivery, installation, and acceptance, to determine whether or not there is compliance with the requirements of these specifications.

B. Approval prior to the time of final acceptance shall not preclude rejection of delivered items which do not satisfy these specifications.

1.11   REORDERING
A. All items specified herein shall be available to the owner in additional quantities for a period of ten (10) years after completion of all work called for in this specification.

1.12 WARRANTY

A. All warranties on fabricator’s standard contract forms must be modified to match warranty criteria mentioned herewith. Any changes in warranty length or criteria must be negotiated prior to contract signing. Any discrepancies from fabricator’s contract are superseded by this performance specification.

B. Warrant all products (including, but not limited to, materials, hardware, and finishes) against any and all defects for a minimum period of two (2) years from the date of installation.

C. Correct any and all defects in material and/or workmanship which may appear during the warranty period by restoring defective work to the standard of the contract documents at no cost to the owner and to the owner’s satisfaction.

D. Vinyl die-cut letters shall be warrantied for five (5) years against delamination from substrate.

E. Paint finishes shall be warrantied for seven (7) years against chalking and fading.

F. Additional corrections shall include, but not limited to, the following:

1. Bubbling, crazing, chalking, rusting, or other disintegration of the sign face, or of the messages, or of the edge finish of the sign inserts or panel.

2. Corrosion developing beneath paint surfaces of the support systems (except when it is the result of obvious vandalism or other external damage to the paint surfaces).

3. Corrosion of the fastenings.

4. The signs not remaining true and plumb on their supports.

5. Fading of the colors when matched against a sample of the original color and material.

6. Discoloration of metal finishes.

7. Uneven illumination; dark or hot spots.
1.13 ALTERNATE FABRICATION

A. These drawings show design intent only. The fabricator is responsible for fabrication and the overall level of quality. Any changes in design, materials, fabrication techniques, or details necessary to the successful completion of this project should be communicated to owner in a timely fashion.

B. Further development and engineering of designer’s details (for fabrication and installation) is expected and should be shown in the shop drawings.

C. The designer recognizes that manufacturers may have shop fabrication techniques that differ from details shown. Suggested changes in fabrication that do not alter the design intent nor reduce the quality will be considered by the designer provided they are submitted in sketch form as soon as possible to shop drawing preparation.

PART 2 PRODUCTS

2.01 SIGN TYPES

A. Factory silkscreen
   1. On aluminum

B. Vinyl legends (letters or other die-cut shapes)
   1. On aluminum

C. Aluminum structures
   1. Extrusions, as noted
   2. Aluminum sheet or plate, rolled as necessary
   3. Aluminum hardware

D. Tactile and braille signs

2.02 DESIGN REQUIREMENTS

A. Type specifications
   1. Typeface: the following typefaces as manufactured by Adobe Systems are used (NO substitutions will be accepted; if sign fabricator’s software or equipment uses a different “cut” or
version of typeface specified, fabricator is required to scan correct version or otherwise arrange to procure it):

a. Helvetica Regular

b. Helvetica Bold

2. See design intent drawings for font and letter spacing samples.

3. Size: all letter heights specified are based on the “X” height of a capital letter.

4. Alignment: when setting type or installing cut letters, ensure that letters are perfectly straight and even, with no characters set crooked or “popping up”.

5. Spacing

   a. See drawings for samples of letter spacing programs. The proper letter and work spacing is of extreme importance to the desired look of the signs.

   b. Contractor is responsible for visual corrections to the typesetting that might be necessary. Any problems in spacing or copy fitting should be brought to the attention of the owner for solution.

B. Visual Justification

1. Display type may align mechanically but not optically. When flushing copy messages left, a visual adjustment shall be made compensating for those letter forms that must be extended into the left hand margin to appear flush. For example, S and O must extend beyond the left margin slightly.

C. Arrow and Symbol Specifications

1. Symbols: symbols and pictograms shall conform to the symbol signs issued by the Department of Transportation and the American Institute of Graphic Arts. To obtain more information and reproduction artwork or digitized Macintosh compatible AIGA symbols, contact:

   a. Society for Environmental Graphic Design 1000 Vermont Avenue Suite 400 Washington, DC 20005; 202-638-5555
2. Arrows on all signs shall use the camera ready artwork or digitized Macintosh compatible arrow files which will be provided by the owner to the successful bidder.
   a. Arrow size will be dimensioned by height as shown in the drawings.

D. Artwork

1. The contractor shall be responsible for preparation of all artwork (including, but not limited to type, arrows, imagery, drawings, photographs, symbols) necessary beyond that provided with contract award and for any touch-up of artwork for photographic enlargement. Quality of artwork for finished signage shall be the responsibility of the contractor. The owner’s representative reserves the right to reject artwork if it fails to meet the standard of quality established.

2.03 MATERIALS

A. Aluminum extrusions: for mounting plates and structural frames shall conform to ASTM B-221, Alloy 6063-T6. Shapes, sizes and weight of members shall be as required for structural stability. All connections of aluminum members shall be heli-arc welded, continuous fillets, ground smooth on all exposed faces, unless specifically detailed otherwise. Aluminum finishes shall hereinafter be specified.

B. Aluminum sheet and plate: type 5052-H-32 alloy aluminum, thickness as indicated. For painted finishes, faces shall be etched to give even satin finish and remove oxidation, then conversion coated to improve paint adhesion and inhibit corrosion. Surface shall be belt-sanded for a smooth finish, edges filed and ground then immersed in hot alkaline cleaner to remove contamination. For anodized finish, prepare for finish AA-M31C21-A31.A
   1. Aluminum should have consistency of color and finish throughout the project.

C. Hangers, brackets and accessories: shall be of the type and size indicated. Where such items are not specifically called for provide hangers, brackets and accessories as required for the proper execution of the work, as approved by the owner.

D. Paint for aluminum
   1. Matthews Acrylic Polyurethane, an ultraviolet inhibited aliphatic isocyanate acrylic system engineered for extreme
gloss and color retention, or approved equal. Degree of gloss is specified in design drawings. One coat 74-734 and 74-735 metal pre-treat at .25 mils DFT or one coat 74-7393 spray bond at .15 to .25 mils DFT and one coat Matthews Acrylic Polyurethane a.25 mils DFT.

2. All coatings to protect by uniformly penetrating, filling, and sealing surface pores. Coating should provide an invisible barrier to weathering, airborne contaminants, graffiti, industrial air pollution, mildew, and salt air. Coating should not yellow, eel or flake. Coating should be guaranteed a minimum of seven (7) years. Sign panels shall be predrilled in proper locations before any priming, painting, or coating processes. Aluminum should have consistency of color and finish throughout the project.

3. Powder coatings for posts and mounting hardware shall be TGIC Polyester, Carbide Black, with product code UFB-506-T1, as manufactured by DuPont Powder Coatings 1-800-247-3886, Houston Texas, or approved equal. Samples shall be submitted for owner's approval.

E. Pressure sensitive legends

1. Use “Scotchcal” brand film manufactured by 3M, or approved equal.

   a. Thickness: .003 inch minimum, .006 inch maximum. Material shall consist of a tough, flexible, pigmented, vinyl film and shall be processed with compatible screen printing inks and clear coatings as recommended by the film manufacturer. The film shall be pre-coated with pressure-sensitive adhesives. The adhesive shall be protected by a treated paper liner which shall be easily removable without soaking in water or other solvents.

2. Use “Scotchlite” brand reflective sheeting manufactured by 3M, or approved equal.

   a. Thickness: .0065 inch minimum, .0075 inch maximum. Material shall consist of transparent plastic having a smooth, flat outer surface embedded with spherical lens elements. Material shall be capable to be processed with compatible screen printing inks and clear coatings as recommended by the sheeting manufacturer. The sheeting shall be pre-coated by a
treated paper liner that shall be easily removable without soaking in water or other solvents.

3. Shall be guaranteed against delamination for a period of five (5) years.

F. Silkscreened ink: formulate epoxy silkscreen inks specifically for surfaces on which they will be used. Add catalytic or bonding agents as necessary to maximize adherence and vandal resistance.

G. Concrete: cast-in-place concrete shall meet the requirements of section 03300 and as follows:

1. All concrete footers are to be poured in place.

2. All concrete footers are to be poured from thoroughly mixed and agitated concrete in order to prevent unreasonable voids in the finished casting.

3. Concrete to meet specified “PSI Test” for strength: 3,500 psi minimum.

4. Concrete to meet specified “Slump Test” before pouring footing.

5. All footings to extend past the frost line.

6. Any footers or posts for signs will be placed in wet concrete and allowed to fully cure in place before any signage is attached or mounted to it in any way.

7. Finish: all exposed faces of concrete shall receive a finish to match existing, adjacent surfaces.

H. Adhesive tape: closed-cell foam tape with adhesive surfaces on both faces. Thicknesses and widths of tapes shall be as required to safely secure signs to various wall finishes, but in no case shall be less than 1/16 inch thick and 1/2 inch wide. Adhesive tape shall be equal to Norton Sealant Tape No. 1001 Series, or approved equal.

I. Liquid adhesive: Silicone Silastic 732 RTV adhesive / sealant as manufactured by Dow Corning, or approved equal.

2.04 FABRICATION
A. Report any discrepancies between drawings, specifications, and owner requirements and request direction from owner before proceeding.

B. Verify measurements in field as required for work fabricated to fit job conditions. Before starting work, examine adjoining work on which work of this section is in any way dependent for perfect workmanship and fit.

C. Make work in ample time not to delay job progress and deliver a job at such time as required for proper coordination. Fabricate work true to line and detail with clean, sharply defined profiles. Finish surfaces smooth unless otherwise specified.

D. Do cutting, punching, drilling, and tapping required for attach mentor other work coming in contact with signage work where indicated.

E. Changeability: fabricate signs in such a manner that each of the major mounting components may be removed and replaced with similar components by maintenance personnel, but not by unauthorized personnel.

F. Construction: fabricate all joints, corners, miters, etc., with work accurately machined, filed, and fitted, rigid framed together at joints and contact points. Carefully match all work to provide a perfect continuity of lines and design, with metal in contact having hairline joints. Make joints of such character and assembly to be strong and as rigid as adjoining sections. Make exposed joints where joint is least conspicuous. Corners shall be square as indicated. All edges shall be finished and free of saw marks.

1. Allow for expansion and contraction of materials from temperature changes, especially when two materials with different coefficients of expansion are used together.

2. Detail signs to minimize deflection from snow, ice, water, or their own weight.

G. Engineering: the system shall be engineered to eliminate buckling of any members, failure at any points, distortions, or other damage.

1. The system shall be engineered to be rigid with minimum deflection and rotation under stress and shall be able to withstand movement, shear, and torsional loads.

2. Exposed areas of signs shall not oilcan. Signs shall be designed as structurally self-supporting units. The suspension
systems and substructure shall be designed by the sign manufacturer to perform in accordance with the contract documents.

H. Connections and accessories: weights of connections and accessories shall be adequate to sustain and withstand stresses and strains to which they will be normally subjected.

I. Sign panels - general

1. Surface finish: provide surface finishes that are free from lines, mottling, ridges, variations in color, orange peel, bubbles, pinholes, mottling, crazing, grit, and coarse particles. This applies to all methods of fabrication and finishing. Use clear coatings for durability, surface protection, appearance, and maintenance.

2. Material: sign panel material is stated in the schedules under “Specifications” and / or on drawings.

3. Opacity: all signs shall have opaque background and opaque graphics.

4. All colors, especially in the aluminum signs, are to be clear and match references exactly. Washed out or weak colors will not be accepted.

J. Anchors and fastenings:

1. Mechanical

a. Provide anchors and fasteners required to secure work in place.

b. Surface finish: do not expose fastenings on surface of sign panels unless specifically noted otherwise. Do not deform, distort, or discolor sign face surfaces by attachment of concealed fastenings.

c. Corrosion resistance: all fastenings shall be non corrosive and resistant to oxidation or other corrosive action, of the same composition completely through their cross sections, particularly when used below grade. Use highest quality stainless steel hardware and fasteners.

d. Anchors, inserts, or fasteners shall be compatible with sign materials, shall not result in galvanic action or
chemical interaction of adhesives and shall have demonstrable and sufficient strength for intended use.

e. Steel anchors and fastenings for exterior use shall be galvanized in accordance with ASTM A153.

f. Stability: Fabricate and install signs with fastenings to withstand all actions imposed by use; 30 psf wind perpendicular to surfaces, water, ice, snow loads, and similar forces.

g. Anchor bolts in concrete shall be cast in place. Manufacturer shall furnish instructions for the setting of anchors and bearing plates. Manufacturer shall ascertain that the items are properly set during the process of the work.

h. Color: Secure work with fastenings of the same color and finish as the components they secure where they are exposed to view, unless noted otherwise.

K. Messages

1. Layouts: layouts are shown on the drawings. All messages shall be centered unless noted otherwise. Correct line breaks are indicated in the “Message” column of the Sign Message Schedule and should be followed exactly. Any problems in message layout shall be brought to the attention of the owner for solution.

2. Fabrication: execute all signs such that letter forms are true and clean. Letter forms with rounded corners, or chipped, nicked, cut, or ragged edges, will not be accepted. This applies to all methods of fabrication and copy application.

3. Copy: message copy on detail drawings is for layout purposes only. Actual copy is listed in the “Message” column of the schedule. Certain copy may be provided later by the owner.

4. Capitalization: Directions for upper and lower case are found in the “Message” column of the schedule and must be followed exactly.

5. Single or Double Faces: All signs that are double-sided will be noted as such in the drawings and message schedule. For double-sided signs, the message will be indicated as “Side A” and “Side B”.

Identifying Devices 10400-16
L. Surface-applied messages

1. Reflectivity and specular gloss
   a. Non-reflectorized message: 60 degree specular in accordance with ASTM Test D523.

2. Thickness: as indicated in specifications herein.

3. Color and color fastness
   a. Exposed surfaces and finishes shall show no discernible color change or chalking when exposed for 1,000 hours in Atlas Twin Arc Weathermaster Model HCDL-X, or approved equal, when tested in accordance with ASTM D822.

4. Interletter spacing: follow examples in drawings, Show sample interletter and interword spacing in sample submission as specified.

5. Layout: positions for all messages, symbols, arrows, lines, etc. for all signs are clearly indicated on the drawings, and shall be complied with.

6. Artwork: contractor shall be responsible for all final reproduction artwork for all messages, symbols, arrows, and restroom floor plan drawings.

7. Fabrication
   a. Screened messages: execute all silkscreen printing in such a manner that all edges and corners of finished letter forms are true and clean. Letterforms, color areas, or lines with rounded corners, edge buildup or bleeding, sawtoothing, etc., will not be accepted. Execute all silkscreen from photoscreens prepared from typesetter’s reproductions shall be no smaller than 75% of the actual size specified. All above work is included in this contract. Hand cut screens will not be acceptable.

   b. Die-cut messages: die-cut, pre-spaced, pre-aligned messages (numbers, words, phrases, and arrows) from 3.0 mil flexible film coated with continuous adhesive pressure sensitive backing to meet characteristics specified for surface-applied messages. Execute die-cutting in such a manner that all edges and corners of
finished letterforms are true and clean. Letter forms with round positive or negative corners, nicked, cut, or ragged edges, etc., will not be accepted

2.05 ALUMINUM STATION IDENTIFICATION SIGN MANUFACTURERS

A. Provide signs as manufactured by:
   1. Sign Comp, Comstock, Michigan
   2. Philadelphia Sign Company, Palmyra, New Jersey
   3. Sweet Sign Systems, Doylestown, Pennsylvania
   4. Or Engineer's approved equal.

2.06 INFORMATIONAL AND DIRECTIONAL SIGNAGE


B. SIGN SIZES:
   1. Length: Dependent on sign message
   2. Depth: .125 inch
   3. Height: Dependent on number of lines

C. CHARACTER SIZE: 4 inches (capital letter ht.) for single line signs and 3 inches (capital letter ht.) for multiple lines. Character thickness to be 0.6875 inches. Provide a 1.5 inch high black bar across the top of all signs.

D. CHARACTER TYPEFACE: Helvetica Bold Italic

E. SIGN BASE MATERIAL: .085 inch extruded aluminum crossbuck with .112 inch legs. Affix .125 inch aluminum strips to sides (vertical edges) of all signs.

F. SIGN FACE MATERIAL: White, non-reflective vinyl sheeting similar to products manufactured by 3M, Avery or approved equal. Characters are to be black. Graffiti protection layer over all signs of overlay film similar to 3M 1150.

G. MOUNTING DETAILS: Per reviewed shop drawings for all signs.

2.07 INFORMATIONAL DIRECTIONAL SIGN MANUFACTURERS
A. Aluminum:
   1. Vulcan Aluminum P.O. Box 1850 Foley, AL 36536-1850
   2. Or Engineer’s equivalent equal.

B. Signs:
   1. East Coast Sign & Supply Inc.
   2. United Sign System
   3. Or Engineer’s approved equal

2.08 TACTILE AND BRAILLE SIGNS

A. GENERAL:
   1. Signs shall be equivalent to die-raised aluminum signs manufactured by Supersign Co. Detroit, MI; Sign Lite, North Haven, CT; or Engineer’s approved equal.
   2. Signs are to be manufactured in compliance with ANSI Standard A117.1 (Accessible and Usable Buildings and Facilities), and the Americans with Disabilities Act Accessibility Guidelines (ADAAG) Section 4.30.

B. PROVIDE: Tactile and Braille signs of type, text and in locations as scheduled on the Contract Drawings.

C. MATERIAL:
   1. Sign Panels
      a. Signs shall be manufactured from sheets of anodized aluminum alloy AQ5006-H32 and conforming to ASTM specifications. Finished thickness of signs, including raised areas, shall be 0.102”. Finished thickness of signs, exclusive of raised areas, shall be 0.07075”
   2. Letters/Pictograms/Header line
      a. All shall be raised 1/32” Integral with the sign face by means of die-stamping. Letters, pictograms, header lines shall have well defined, but not sharp edges.
   3. Vandal Resistance Level
a. All raised characters, as well as the sign base shall be scratchproof. Sign finish shall not deteriorate upon application of graffiti removal products.

D. DIE-RAISED LEVEL:

1. Features

a. Tactile Characters: 5/8 “-1” Helvetica Medium uppercase letters; die-raised; tactile text, depending on expected size/message of sign. Contractor to be instructed which size to use on a per sign basis. Glue-on letters or etched backgrounds are not acceptable.

b. Pictograms: 4” tactile pictograms.

c. Braille characters: Grade 2 Braille to be used, with translation to be provided by signage manufacturer, and certified by an independent organization or agency specializing in services for the blind, to be selected by the manufacturer.

d. Signs to have corners rounded with a ½” radius, and have no borders.

e. Signs to have a raised white line across length of sign, one inch from the top of the sign.

f. Holes for mounting screws/anchors shall be pre-drilled in each corner of each sign.

2. Color

a. Background: Baked enamel black finish with clear coat in eggshell finish.

b. Copy: Tactile characters, pictograms and header line to be white.

3. Mounting

a. 5/16” holes shall be pre-drilled in each corner of each sign by the manufacturer. Screws shall be tamper-proof.

b. Sign mounting will be in accordance with ADA Accessibility Guidelines height and clearance requirements.
c. The Contractor shall verify that the Braille message matches the text message.

d. Each sign shall include a complete installation kit with stainless steel, non-removable /clutch head screws.

PART 3 EXECUTION

3.01 PREINSTALLATION MEETING

A. A meeting with SEPTA PM is required prior any installation.

3.02 INSPECTION:

A. INSPECTION: Install no work until surfaces on which signage and other Work of this Section are to be placed and attached are free of defects and are in a completed conditions.

B. Examine the substrates and conditions under which the signs are to be installed and notify the owner in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. GENERAL: All surfaces to receive placement of Work of this Section shall be clean and dry.

3.04 INSTALLATION

A. Install sign units and components with concealed fasteners, unless otherwise shown. Refer to detail drawings for general method. Verify each surface in field to determine specific, appropriate hardware.

1. Drawings in this package may not indicate any below ground or in-wall structural tie-ins or connections that may be necessary to assure stable and secure installation of signs. Sign fabricator is responsible for determining where such connections are necessary and for coordinating with related trades to make them.

B. Locations: refer to drawings for approximate locations. Any discrepancies or apparent deviations from drawing locations because of different site conditions shall be brought to the attention of the owner for solution. The owner must be present for field placement of sign.
1. It shall be the responsibility of the Contractor to determine the location of underground structures and utilities by the use of test pit excavation prior to excavation operations.

2. Test pits shall be of the size, depth, and location as approved by the Engineer. Each pit shall be tamp-back-filled.

3. Test pit excavation will be measured on the basis of the volume of material actually removed from within the limits specified. Tamped backfill will not be measured but shall be included in the price bid for test pit excavation.

4. Price provided shall include all excavation, tamped backfill, labor, tools, equipment, and incidentals necessary to complete the installation of each sign.

C. For ground-mounted signs, provide whatever replacement concrete, pavers, bricks, etc. are necessary to match adjacent surfaces exactly. Seams should be parallel or perpendicular to sign face and be symmetrical around post(s).

D. Note that this institution experiences heavy public use. Strong environmental conditions such as weather and vandalism may be routine problems. Signs must be securely mounted. Contractor is responsible for suggesting alternate fabrication or installation methods. If required to prevent theft or vandalism.

E. Install signs to be level, plumb, and at the proper height. Cooperate with other trades for installation of sign units.

3.05 CLEAN-UP AND PROTECTION

A. Periodically and upon completion of the installation, remove all waste, dirt, wrappings, and excess materials, tools and equipment, and carefully and thoroughly clean all surfaces to the satisfaction of the owner.

1. Clean all surface with suitable materials.

2. Remove excess adhesive.

3. Remove all debris from Work area.

4. Remove protective covers at Project Completion.

3.06 PROPERTY DAMAGE
A. Protect all adjacent surfaces from damage and pay the cost of repairing any damage to the property caused by delivery or installation of materials. In all cases, match existing surfaces.

3.07 SIGN SCHEDULE

A. SIGN SCHEDULE:

1. See sign schedule on Drawings.

END OF SECTION
THIS PAGE NOT USED
SECTION 10415

BULLETIN BOARDS OFF THE SHELF

PART 1    GENERAL

1.01   DESCRIPTION

A. The work of this section consists of the fabrication and delivery of openable, lockable anodized aluminum bulletin boards with lexan window and vinyl-covered cork tackboards as shown on the contract drawings and specified herein.

1.02   SUBMITTALS FOR APPROVAL

A. Provide (6) copies of manufacturer's catalog cuts, color charts and product literature for all products including but not limited to hinges, locksets, tackboard, lexan window, window frames, window gasketing, and vandal shield.

1.03   WARRANTIES

A. The Contractor shall provide manufacturers' standard warranties for all products, including but not limited to, lexan windows, window frames, tack boards, locksets, and hinges.

1.04   DELIVERY, STORAGE, AND HANDLING

A. Package so that products will not be damaged during shipping or storage.

B. Clearly label each package of contents. Label shall be on (2) ends and (1) face. Contents shall be labeled and coordinated with installation drawings.

C. Ship items to SEPTA location as described in purchase requisition.

PART 2    PRODUCTS

2.01   MANUFACTURER

A. Displays4sale, Freeport, NY

B. AARCO Products Inc. Yaphank, NY

C. School Outfitters, Cincinnati, OH

D. Or Approved Equal
2.02 MATERIALS

A. Aluminum angles shall be 6063 alloy with sharp corner cross section.

B. Aluminum bars, rectangles, sheets, and plates shall be 6061 or 6063 alloy.

C. Stainless steel piano hinges shall have 0.05" thick leaves with 1-1/2" open width and 1/8"∅ non-removable pin.

D. Locking device shall be key-operated 3-point latch mechanism. Key shall be removable in locked and unlocked positions.

E. Window shall be 0.20" - 0.30" thick MR10 Lexan sheet with Vandal Shield adhesive laminate on exterior face. Window shall be factory-framed and gasketed with 16 - 20 GA aluminum U-channels with neoprene gaskets on entire perimeter with mitered corners.

F. Tackboard shall be 1/8" thick cork sheet with minimum 1/16" thick vinyl cover.

G. Rivets and Anchors.

H. Size: 36" W x 48" H

2.03 FINISHES

A. Aluminum fabrications shall be anodized

B. The tackboard color shall be selected by SEPTA Project Manager from manufacturer's standard colors at time of shop drawings/submittals.

C. Vandal Shield

1. Lexan window shall be installed with a protective polyester anti-graffiti .006 thick film with an acrylic coating made up of (3) .002 mil layers bound with water based adhesive known as "vandal shield". Provide vandal resistant film on both sides of glass for the entire window panel.


PART 3 EXECUTION

3.01 PACKAGING AND SHIPPING
A. Wall-Mounted Bulletin Boards shall have the "poster backer" shipped separately.

B. Bulletin boards and frames shall be installed by the general contractor.

END OF SECTION
SECTION 10522
FIRE EXTINGUISHERS, CABINETS, AND ACCESSORIES

PART 1    GENERAL

1.01 SECTION INCLUDES

A. Requirements for fire extinguishers, cabinets, and accessories

1.02 STANDARDS AND REGULATIONS

A. National Fire Protection Association (NFPA):
   1. NFPA 10: Portable Fire Extinguishers

B. Underwriters Laboratories Inc. (UL):
   1. UL 299: Dry Chemical Fire Extinguishers
   2. UL 11: Rating and Fire Testing of Fire Extinguishers

1.03 SUBMITTALS

A. Shop drawings showing locations and rough-in measurements for cabinets.

B. Product data.

C. Maintenance data, including test, refill or recharge schedules, and re-certification requirements.

D. All submittals are to be in accordance with general requirements in Division 1

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Schedule delivery of materials at the site at such time as required for proper coordination of the work. Receive materials in manufacturer’s unopened packages and bearing manufacturer’s label.

B. Storage:
   1. General: Store materials in a dry and properly ventilated structure. Adequately protect from damage and exposure to the elements.
   2. Temperature: Maintain minimum of 45 degrees F and a maximum of 90 degrees F.
PART 2 PRODUCTS

2.01 EXTINGUISHERS

A. Conform to NFPA 10 and UL 711.

B. Multi-purpose dry chemical type: Conforming to UL 299, stainless steel tank, with pressure gage; 20A-120B: C UL rating, Model MP 20, as manufactured by Larsen’s Manufacturing Company, or engineer’s approved equal. One per cabinet.

C. Finish: Steel, enamel to manufacturer’s standard red color.

2.02 CABINETS

A. Architectural Series as manufactured by Larsen’s Manufacturing Company; Type 1: Surface-mounted, 3612-SM, or Engineer’s approved equal.

B. Metal: Formed sheet steel, primed; 18 gage thick base metal.

C. Configuration: Surface mounted type, inside box dimensions of 12 inches wide x 36 inches high x 8 inches deep.

D. Trim type: Trimless type for surface-mounted.

E. Door: 18 gages thick, reinforced for flatness and rigidity; latch access, hinged for 180° opening with continuous piano hinge, with roller type catch.

F. Door glazing: Glass, clear, wire glass with resilient channel gasket glazing.

G. Mounting hardware: As provided by manufacturer.

H. Finishes:
   1. Exterior trim and door: Primed for field paint finish-red.
   2. Interior: White enamel.

I. Signage: Vertical die cut lettering, black. Graphic identification: FIRE EXTINGUISHER.

PART 3 EXECUTION

3.01 PREPARATION

A. Transmit submittals required by this Section.

B. Provide products as indicated.
C. Ensure substrates are in suitable condition to receive the work.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level, 26 inches from finished floor to bottom of cabinet, and secure rigidly in place.

END OF SECTION
THIS PAGE NOT USED
SECTION 12502
TRASH RECEPTACLES - OFF THE SHELF

PART 1 GENERAL

1.01 DESCRIPTION

1. The work of this section consists of the fabrication and delivery of steel trash receptacles with a powder coat finish as shown on the contract drawings and specified herein.

2. The Contractor shall be responsible for all materials, labor and transportation required for delivery of complete assemblies to a location(s) designated elsewhere in the Contract Documents.

1.02 SUBMITTALS FOR APPROVAL

1. Provide submittals in accordance Section 01300

2. Provide (3) copies of manufacturer’s catalog cuts, color charts and product literature including finishing process guidelines.

3. Manufacturer shall supply certification of finishing process as specified herein and noted on the schedule on the drawing.

1.03 DELIVERY, STORAGE, AND HANDLING

1. Package so that products will not be damaged during shipping or storage.

2. Clearly label each package of contents. Label shall be on (2) ends and (1) face. Contents shall be labeled and coordinated with installation drawings.

PART 2 PRODUCTS

2.01 TRASH RECEPTACLE

A. SD-242, Ironsites Series as manufactured by Victor Stanley, Inc. PO Drawer 330, Dunkirk, MD 20754, Phone: (301) 855-8300, or

B. CRTR2, Carnival Series as manufactured by Thomas Steele, 1080 Uniek Drive, Waunakee, WI 53597, Phone: (608) 849-1080, or

C. SF34X2D, Sentinel Series as manufactured by Belson, Inc. 111 North River Road, North Aurora, IL 60542, Phone: (800) 323-5664

D. Or Approved Equal. Equals shall be judged during the technical evaluation process by SEPTA’s project manager.
2.02 FABRICATION

A. Steel slats shall be nominal 1 1/2" to 2" bar stock. Laser cut sheet is unacceptable.

B. Lid

1. Lid shall be flat with a hole for deposits
   a. Trash: 10"-12" diameter hole
      1) Color: Black
   b. Recycling: 5"-6" diameter hole
      1) Color: Bright Blue

C. Material

1. Steel section plates, shapes and bars: ASTM A36.
2. Steel welded and seamless pipe: Schedule 40 and 80, ASTM A120, A53 and A36.
3. Square & rectangular steel HSS: ASTM A500, grade B.

D. Finish:

1. Powder Coating per section 09000 - finishes

PART 3 EXECUTION

3.01 Refer to Section 01100 Summary of Work.

END OF SECTION
SECTION 12503
BENCHES - OFF THE SHELF

PART 1   GENERAL

1.01 DESCRIPTION

A. The work of this section consists of the fabrication and delivery of steel benches with a powder coat finish as shown on the contract drawings and specified herein.

1.02 SUBMITTALS FOR APPROVAL

A. Provide submittals in accordance Sections 01100 and 09900.

B. Provide (6) copies of manufacturer's catalog cuts, color charts, and product literature.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Package so that products will not be damaged during shipping or storage.

B. Clearly label each package of contents. Label shall be on (2) ends and (1) face. Contents shall be labeled and coordinated with installation drawings.

C. Ship items to SEPTA location as described in purchase requisition.

PART 2   PRODUCTS

2.01 8'-0” Exterior Bench

A. Pullman model P28 as manufactured by Keystone Ridge Designs, Inc. P.O. Box 2008, Butler, PA 16003, Phone: (800) 284-8208, or

B. PL-3 model as manufactured by FairWeather Site Furnishings, 1525 Vivian Court, Port Orchard, WA 98367, Phone: (800) 323-1798, or

C. Mirage model as manufactured by Creative Pipe, Inc. P.O. Box 2458, Rancho Mirage, CA 92270, Phone: (800) 644-8467, or approved equal.

D. Anchors - refer to Section 05090.
2.02 FINISHES
   A. Powder coat finish shall be in accordance with Section 09000.

PART 3 EXECUTION

3.01 EXECUTION
   A. Refer to Section 01100 Summary of Work.

END OF SECTION
SECTION 12504
BIKE RACK – OFF THE SHELF

PART 1    GENERAL

1.01 Description

A. The work of this section consists of the fabrication and delivery of steel bicycle lock rack(s) with a powder coat finish as shown and in the quantities as specified herein.

B. The Contractor shall be responsible for all materials, labor and transportation required for delivery of complete assemblies to a location(s) designated elsewhere in the Contract Documents.


1.02 Submittals

A. Provide (3) copies of manufacturer's catalog cuts, color charts and product literature including finishing process guidelines.

B. Manufacturer shall supply certification of finishing process as specified herein and noted on the schedule on the drawing.

PART 2    PRODUCTS

2.01 Products

A. Bike Hoops

   1. HS Series (3 Bike Capacity) as manufactured by Creative Pipe, PO Box 2458, Rancho Mirage, CA 92270, Phone: (800) 644-8467, or

   2. Or Approved Equal. Equals shall be judged during the technical evaluation process by SEPTA’s project manager.

2.02 Fabrication

A. Material

   1. Steel section plates, shapes and bars: ASTM A36.
2. Steel welded and seamless pipe: Schedule 40, ASTM A120, A53 and A36.


B. Finish:

1. Refer to Powder Coating Specification Section.

2. Refer to Schedule for Color Information.

PART 3 EXECUTION

3.01 CONSTRUCTION

A. Install Bicycle Racks with in-ground anchor mount as specified on the contract plans. All fasteners and bolts to be stainless steel or galvanized steel.

B. Refer to Section 01100 Summary of Work.

END OF SECTION
SECTION 13121

PRE-FABRICATED STATION BUILDING AND CANOPY

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of providing a station building as shown on the drawings and specified herein. The building shall be prefabricated to the maximum degree possible requiring minimum on-site assembly and finishing. The contractor shall be responsible for transporting; placing, assembling, finishing, and anchoring the building to an installed foundation system as specified herein and shown on the drawings.

B. The contractor shall be responsible for all aspects of transporting the building to the site and its assembly, placement and anchorage to the foundation system. This shall include route planning, obtaining roadway access permits and any specialty equipment / cranes required for lifting and setting the building on their foundation system.

C. The building shall be provided complete with all electrical wiring, HVAC equipment & installation and plumbing. The plumbing shall be stubbed into the basement and connected to the main sanitary and water supply lines provided within the basement area.

D. The contractor shall be responsible for furnishing and installing the building ceiling system, steel pipe columns embedded in the wall system, floor system, and all other building components as described on the drawings and elsewhere in these specifications. The contractor shall extend all plumbing vents up through the building roof system as required and provide all necessary wiring for lighting associated with the building.

E. The contractor shall be responsible for installing interior finishes as shown on the drawings and specified herein. Where possible, interior finishes shall be factory installed to minimize duration of on-site work.

F. The contractor shall be responsible for windows and all exterior envelope and finish systems unless otherwise noted on the drawings.

G. The contractor is responsible for installing a complete exterior finish system unless otherwise noted on the drawings. The system,
described on the drawings and elsewhere in these specifications shall be a complete system consisting of a vapor barrier, wall insulation masonry ties, masonry veneer, and decorative masonry accessories such as lintels, jambs, and water tables.

1.02 RELATED WORK

A. Section 01060 – Regulatory Requirements and Safety
B. Section 01065 – Railroad Safety Requirements
C. Section 01300 – Submittals
D. Section 01401 – Quality Requirements
E. Section 04210 – Clay Masonry Units
F. Section 07410 – Metal Roofing and Wall Panels
G. Section 08110 – Metal Doors and Frames
H. Section 08310 – Access Doors and Panels
I. Section 15100 – Building Services Piping
J. Section 15410 – Plumbing Fixtures
K. Section 15670 – Heating, Ventilation and Air Conditioning
L. Section 16123 – Building Wire and Cable
M. Section 16130 – Electrical Boxes
N. Section 16530 – Site Lighting

1.03 REFERENCES

A. All applicable building codes adopted by the local municipality where the building is located.
B. Americans with Disabilities Act (ADA) 1990
C. Americans with Disabilities Act Accessibility Guide (ADAAG)
G. The latest edition of the National Electrical Code (NEC).
H. All construction must comply with the Pennsylvania Act 222 Energy Regulations.

1.04 QUALITY ASSURANCE

A. The building fabricator must have documented experience manufacturing and setting at least (10) other similar types and sizes of buildings.

B. Subcontractors working on site must have documented experience in this type of construction and must be fully licensed and qualified. It is the responsibility of each subcontractor to pay all necessary fees and charges to the local municipality.

C. All shop drawings, picking plans, etc. shall be done under the direction of a professional engineer licensed in the State of Pennsylvania.

1.05 DESIGN REQUIREMENTS

A. Structure Classification: Occupancy Category II

B. Design Loads
   1. Exposure Category: C
   2. Importance factor: 1.0
   3. Basic Wind Speed: 100 mph (3 second gust)
   4. Ground Snow Load: 30 psf
   5. Floor Live Load: 150 psf (2000 lbs concentrated load)

C. Seismic Load:
   1. Site Class: D
   2. Seismic Use Group: I

D. Load Combinations: per the latest edition the IBC

E. Ceiling and Roof Systems
1. The modular building will have the roof framing and roofing systems installed in field, with the exception of the steel columns embedded in the building walls as described on the drawings and elsewhere in these specifications. The interior ceiling may be an integral part of the modular building or may be attached to the underside of the truss. In any configuration the interior of the building must be weather protected during transport and while on the site prior to installation.

2. This contractor shall confer with the general contractor and project engineer to co-ordinate the sequence of construction.

F. References for Lumber Products


5. AWPA C1-03 – Preservative Treatment by Process Processes.


7. AWPA E12: Standard Method of Determining Corrosion Resistance of Metal in Contact with Treated Wood.


H. Grading Rules:


2. Douglas Fir and Hem Fir: West Coast Lumber Inspection Bureau (WCLIB) or Western Wood Products Association (WWPA).

I. Tile installation to comply with the “Tile Council of North America” standards.

1.06 SUBMITTALS

A. Submit under provisions of Section 13000 – Submittals

B. The contractor shall be responsible for providing the engineer/architect with shop drawings, catalog cuts and design calculations for approval. No work shall be started prior to receiving all approvals.

C. Substitutions: It shall be at the sole discretion of the engineer/architect to determine if a substitution meets the specification or not. If the substitution is rejected, then the contractor is obligated to provide the materials or meet the standards as called for in the construction documents. Review and approval will not be granted until all submittals have been received and approved or denied.

D. Manufacturer’s Installation Instructions: Provide published instructions that indicate preparation and installation procedures for all products and materials.

E. Product Data: Submit manufacturer’s product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and products for building.

F. Shop Drawings:

1. Submit small-scale (1/4”=1’-0” minimum) drawings including but not limited to the following:

   a. Plans showing foundation dimensional required layout, first floor and ceiling framing, first floor layout, and reflected ceiling.

   b. Interior and exterior elevations.
c. Sections.

2. Submit large-scale (1 1/2"=1'-0" minimum) details including but not limited to the following:
   a. Anchoring Systems
      1) Building to Foundation
      2) Building to Steel Roof Truss
      3) Building Sections
   b. Material/Framing Connections
   c. Waterproofing and Underlayments

G. The contractor shall provide structural engineering calculations sealed by a Pennsylvania registered engineer, which document all live, dead, snow and wind loads the building has been designed for.

H. The contractor shall provide shop drawings, catalog cuts, schedules, and samples for all materials and systems as shown on the drawings and specified herein. The following is a partial list of items that shall be submitted for review and approval:
   1. Windows, doors, frames, and hardware.
   2. Wall, floor, and ceiling systems, including but not limited to finishes and insulation.
   3. Bathroom floor and wall tile including, underlayment, mortar, and grout.
   4. Flooring
   5. Millwork including but not limited to window and door trim, wainscot, and moldings.
   6. Furniture including but not limited to seating.
   7. Accessories such as bulletin boards and toilet room hardware such as grab bars, mirrors, soap dispensers, toilet paper holders.
   8. Plumbing fixtures and HVAC equipment.
9. Electrical items such as light fixtures, emergency exit signs, emergency lighting, receptacles, switches, and electrical panel boards.

10. Miscellaneous items such as caulks, sealants, gaskets and other items as required to complete and finish the modular building.

11. Exterior finish systems

12. Ceiling Access Hatches

I. Where applicable, submittals shall include samples of standard color and finishes from which the engineer/architect shall choose.

J. The contractor shall provide documentation, which shall detail the route in which the building shall be delivered including copies of any approvals and/or permits required for roadway access.

K. The contractor shall provide independent certification of inspection to document that the building, as constructed, meets all applicable codes and permit requirements.

L. The contractor shall supply all placement information including crane information, pick point calculations, and placement procedures.

1.07 JOB CONDITIONS

A. Fieldwork Coordination:

1. Coordinate the requirements of this building with the fieldwork provided so construction, delivery, placing, assembly, and connection of the building won't be delayed. Identify detailed information to insure the building's construction will match the existing foundation system. This information will include details on depth, width, length, required compressive strength, reinforcing, and anchors.

2. Owner to review this information but it is the sole responsibility of the contractor to take all necessary steps to insure that the building fits on the foundation provided including carefully controlling all plan dimensions.

B. Utility Coordination

1. All electrical and plumbing connections shall be extended through the floor to connect with the provided water, sanitary
and electrical connection. The contractor shall provide detailed utility information so the various utilities such as, sewer, domestic water and electrical service can be successfully connected. Provide locations, sizes, loads, and other pertinent information that would be required by owner/

2. Provide detailed drawings, which identify where utilities shall exit the floor and enter the basement. Provide for plus or minus tolerances. All floor penetrations must be fire-safed.

3. The contractor shall be responsible for extending all plumbing vents through the roof as required by code.

4. At locations where the building will sit on a basement or crawl space, the area will be accessible to the contractor to install ductwork, electrical, and plumbing.

PART 2 PRODUCTS

2.01 LUMBER

A. Lumber members shall be S4S in accordance with published Values of lumber rules writing agencies approved by board of review of American Lumber Standards Committee.

B. Lumber used shall be identified by grade mark of a lumber inspection bureau or agency approved by that Board, and shall be as shown on shop drawings. Moisture content of lumber shall be no less than 7% or greater than 19% at time of manufacture. Species and grade as follows:

1. Framing: SPF or better.

C. Bracing Members: Southern Pine or Douglas Fir, structural No. 2 or Construction grade; or Hem-Fir, structural No. 2 grade.

2.02 METAL CONNECTOR PLATES

A. Metal connector plates shall be 20 gage minimum sheet steel meeting or exceeding ASTM A 653-07, grade 37, and hot dip galvanized according to ASTM A 653-07, coating designation G60.

2.03 BUILDING FRAMING SYSTEM

A. Design Requirements:

1. Floor Framing: 2x12 (single or double)
2. Ceiling Framing: 2x6
3. Exterior Wall Framing: 2x6 with double top and bottom wood plates
4. Interior Wall Framing: 2x4 with double top and bottom wood plates
5. Floor Deck: 3/4" plywood with tongue and groove edge
6. Exterior Sheathing: 5/8" pressure-treated exterior grade plywood
7. Air Barrier – See Specification 07270 – Air Barriers

2.04 INSULATION
A. Inside Exterior Walls: R-21 Kraft Faced Fiberglass Batt
B. Ceiling: R-38 Kraft Faced Fiberglass Batt
C. Floor: R-19 Kraft Faced Fiberglass Batt

2.05 BASEMENT VENTS
A. Mar-Flex Waterproofing and Basement Products/6866 Chrisman Lane/Middletown, OH 45042/800-498-1411
   2. 0.125 Aluminum
   3. With Bug Shield
B. Or approved equal.

2.06 CEILING ACCESS HATCH
A. Nystrom/9300 73rd Avenue North/Brooklyn Park, MN 55428/800-547-2635
   1. Door: FRU 24" x 24" BGM insulated.
   2. Frame: 16 gauge.
   3. Hinge: Concealed continuous rod.
   4. Latch: Mortise lock prep.
5. Finish: Paintable powder coat.

B. Or approved equal.

2.07 DOORS

A. Metal Doors and Frames, see contract drawings for station building locations

1. Standards shall comply with Steel Door Institute “Recommended Specifications for Standard Steel Doors and Frames” (SDI-100), and as herein specified.

2. The building shall be equipped with 16-gauge insulated metal exterior doors and 18-gauge interior doors. Doors and frames shall both be galvanized (ASTM A526 1.25 oz), primed, and finished in one coat of enamel paint to be picked from full range standard colors at time of submittal approval. Doors and frames shall be reinforced for all appropriate hardware; hinges, door closure and lock set. Exterior frames/doors shall be weather-stripped at head, jambs, and threshold.

3. Exterior Doors 101A & 101B: Steelcraft, Cincinnati, OH
   a. Waiting room doors shall be 16 gauge w/ 2 raised panels below a 3’-4” x 2’-0” insulated tempered glass divided lite

4. Interior Doors shall be 18 gauge w/ 6 raised panels.

5. Reinforce top and bottom edges with 14 gauge steel channels extending full width of door and spot welded to both faces. Reinforce vertical edges with 14 gauge channels full height. Provide continuous Z-bar channel truss or hot-shape stiffeners, at least 20 gauge spaced 6” apart full height of door. Close top edges of doors to provide a flush top.

6. Insulate exterior doors to provide a “U” factor of 0.090.


8. Reinforce doors for required hardware as follows:
   a. Hinges: 3/16”x1 1/2”x6” longer than hinge, secured by not less than (6) spot welds.
b. Mortise Lock Sets and Dead Bolts: 14 gauge steel sheet, secured by not less than (2) spot welds.

c. Cylinder Locks: 12 gauge steel sheet, secured by not less than (2) spot welds.

9. Exterior Frames – 14 gauge galvannealed steel set up and welded w/ 10 gauge hinge and door closer reinforcement or approved equal.

10. Interior Frames – 16 gauge steel set up and welded w/ 10 gauge hinge and door closer reinforcement or approved equal.

11. Extend door frames to sub floor surface at openings where finish floor is on fill. Provide 14 gauge floor anchors. Provide a minimum of (3) 14 gauge anchors per jamb. Anchors for installation in new masonry wall to be adjustable "T" strap design not less than 2"x10" in size and corrugated.

12. Reinforce head of frames with 12 gauge channels welded to frame for openings up to 3’ to 8’ wide.

B. Door Hardware (See Section 08710)

2.08 WINDOWS FOR STATION BUILDING ONLY

A. Exterior Windows

1. Exterior windows shall be manufactured by Efco Corp, Monett MO or approved equal. Windows shall be Model No. 660, heavy-duty single hung commercial grade with thermally broken frames.

   a. Frame Material: Extruded aluminum shall be 6063-T5 or T6 alloy and tempered. Finish color to be Sherwin Williams Urbane Bronze or approved equal

   b. Divided lite top sash with snap-in mullions

   c. Continuous interlock meeting rails.

   d. Weather stripped sash and sill.

   e. Automatic bottom sash locks.

   f. Block and Tackle balancers.

   g. “Trim-All” panning system.
h. Bug screens, extruded aluminum alloy frame
i. Anodized paint finish
j. Glazing: Factory glazed 3/4" insulated unit; 1/4" glass, 1/4" air space and 1/4" polycarbonate (polycarbonate facing exterior).
k. Provide Vandal Shield on all glazing

2. Provide all accessories necessary for a complete installation including masonry flashing pans, locks, and insect screens in independent frames.

3. Installation – Install windows on site to obtain a satisfactory seal with the masonry. Package and ship windows in the manufacturer’s original shipping packaging. Protect from the elements during shipping and storage. Store at the site in a safe and secure location.

2.09 FINISHES

A. Exterior Wall Surface

1. Upper: Two Tone Brick (See Section 04200), 4” two tone clay brick veneer, Redland Brick color King William. Mortar: Anchor Lehigh color L25, or approved equal

2. Lower: Pre-Cast Concrete

3. Cast Stone Sills, Door and Window Surrounds

B. Interior Wall Surface

1. Lobby Area: Abrasion Resistant Gypsum Board taped and spackled with Wood Wainscot lower and painted finish upper.

2. Toilet Room: MR Gypsum Board with Mosaic Tile lower and painted finish upper.
   a. Manufacturer: Dal-Tile Corporation/ 7834 C.F. Hawn Frwy./ Dallas, TX 75217/ (214) 398-1411
   b. Local Distributor: Mohawk Tile and Marble/ 410 Swedeland Rd./ King of Prussia, PA 19406/ 610-279-2700
   c. Dal-Tile Keystones: 1”x2” Field Wall Tile #D317 Biscuit, mortar color based on Spec Mix Aspen White. Top band:
2"x2" Stretcher tile w/rounded top edge S-886 color D311 Black, mortar color based on Spec Mix Aspen White. Bottom Band: 2"x1" Stretcher tile S-833 color D311 Black, mortar color based on Spex Mix color Sable, or approved equal.

   a. Manufacturer: Dal-Tile Corporation/ 7834 C.F. Hawn Frwy./ Dallas, TX 75217/ (214) 398-1411
   b. Local Distributor: Mohawk Tile and Marble/ 410 Swedeland Rd./ King of Prussia, PA 19406/ 610-279-2700
   c. Dal-Tile Colour Scheme: 6"x6" Wall Tile Desert Gray. 6"x12" cove base P36C9TB Desert Gray, mortar color based on Spex Mix color Sable, or approved equal.

C. Ceiling
   1. 5/8" Abrasion Resistant Gypsum Board taped and spackled with painted finish.

D. Flooring
   1. Waiting Room/Lobby Area & Ticket Office: VCT
      a. 12"x12" Checker Board Pattern, Armstrong Imperial Texture Standard Excelon, 51811 Antique White and 51942 Curried Caramel, or approved equal
   2. Toilet Room: Mosaic Tile with epoxy grout
      a. Manufacturer: Dal-Tile Corporation/7834 C.F. Hawn Frwy./ Dallas, TX 75217/(214) 398-1411
      b. Local Distributor: Mohawk Tile and Marble/410 Swedeland Rd./King of Prussia, PA 19406/610-279-2700
      c. Dal-Tile keystones, DK20 Windmill Biscuit (1"x2" D317 Biscuit, 1"x1" D311 Black), mortar color based on Spec Mix Sable, or approved equal
      d. Provide Marble Threshold, ADA compliant.
3. Housekeeping Room: Mosaic Tile with epoxy grout
   a. Manufacturer: Dal-Tile Corporation/7834 C.F. Hawn Frwy./Dallas, TX 75217/(214) 398-1411
   b. Local Distributor: Mohawk Tile and Marble/410 Swedeland Rd./King of Prussia, PA 19406/610-279-2700
   c. Dal-Tile Colour Schemes, 18”x18” tile color Desert Gray, mortar color based on Spec Mix Sable, or approved equal
   d. Provide Marble Threshold, ADA compliant

2.10 INTERIOR ACCESSORIES

A. Moldings: All wall molding shall be paint grade Pine that is free of knots, sap pockets or other imperfections.
   1. Finish: (1) Primer and (2) Finish Coats. Color to be chosen by architect during submittal process.

B. Wall-mounted, wood slat benches.
   1. Configuration: As show on the drawings.
   2. Materials: Finish Grade Red Oak slats and trim on red oak plywood supports. Stain and seal.
   3. Fabricate according to American Woodworking Institute-Custom Grade Standards.
   4. Structural Strength: Bench shall be built to withstand 250 pounds of vertical or horizontal force at any point on the seat, fastener mounting device or supporting structure.
   5. Finish: Two coats of clear gloss polyurethane. Apply wood filler in all exposed nail and screw indentations. Use filler that matches surrounding surfaces and of types recommended for the applied finish.
   6. Fabricate and install as shown on the drawings.

C. Interior Bulletin Board
   1. 30”x36” Vinyl Bulletin Board as supplied by Displays to Go, Bristol, RI 02809. SKU #FBTW3036. www.displays2go.com
a. 0.040” Minimum Aluminum Frame  
b. Provide Lockset and Key  
c. Clear Anodized Finish  
d. Provide Vandal Shield on Glass  
e. Or approved equal.

2.11 TOILET ROOM ACCESSORIES

A. All Toilet Room Accessories shall be manufactured by Bobrick, 200 Commerce Drive, Clifton Park, NY 12065-1350, telephone: (518) 877-7444 or approved equal.

B. Grab Bars: No. B-5806 1 1/4” diameter per dimensions on Drawings. Provide snap flange with stainless steel peened finish.

C. Toilet Tissue Dispenser: No. B-4288. Dispenser to have type 304 stainless steel with all welded construction, including dispensing mechanism, inner housing and cam; exposed surfaces shall have satin finish. Front of toilet tissue dispenser door shall be drawn, one-piece, seamless construction. Door shall be secured to cabinet with two rivets and equipped with a flush tumbler lock keyed like other Bobrick washroom accessories. Unit shall dispense two standard-core toilet tissue rolls up to 5 1/4” diameter. Extra roll shall automatically drop in place when bottom roll is depleted.

D. Sanitary Napkin Disposal: No. B-270. Disposal shall have type 304 stainless steel with all welded construction; exposed surfaces shall have stain finish. Cover shall be drawn, one-piece, seamless construction and secured to container with a full-length stainless steel piano hinge. Container shall have integral finger depression for opening cover.

E. Waste Receptacle: No. B-277. Receptacle shall have type-304 stainless steel with all welded construction; exposed surfaces shall have satin finish. Top edge shall be hemmed and bottom of waste receptacle shall have recessed finger grip for safe handling. Waster receptacle shall be equipped with interior clips for securing furnished reusable vinyl liner and shall have reinforced mounting screw holes. Capacity shall be 12 gallons.

F. Mirror: No. B-293. Frame shall be type 304 stainless steel, 1/2” x 1/2” x 1/2” Bobrick channel with 1/4” return at rear with bright polished finish. One piece frame with 90 degree mitered corners.
Mirror frame extends 4” from wall at top and tapers to 1” at bottom. Mirror shall be tempered 1/4” glass – 24” x 36”.

G. Soap Dispenser: No. B-4112. Dispenser shall be type 304 stainless steel construction with satin finish. Container body and back plate are epoxy sealed to prevent warping and leakage. Equipped with a plastic soap refill indicator window and a locked, hinged stainless steel lid for top filing. Capacity: 40 fl. Oz. Hand Dryer:

H. B-7128 (voltage?) 18-gauge, Type 304 stainless steel with #4 satin finish vertical grain cover with UL 94-5VA black plastic trim and side panels. 208-240V aV, 6.8-7.8 Amp, 1400-1900 Watts, 50/60 Hz, Single Phase, touch free auto sensor.

I. Coat Hook: B-6827 Surface Mounted Hat and Coat Hook, Satin Finish Stainless Steel.

2.12 EXTERIOR ACCESSORIES

A. Off the shelf Aluminum Bulletin Boards:
   1. As shown on Drawings and specified herein.
   2. Mounting Board shall be ¼” thick layer of 100% natural cork, laminated to 3/8” thick insulation board. Wrap vinyl around all edges and back.

B. Custom Painted Aluminum Rain Water Leaders
   1. Form to shape as shown on drawings.
   2. Provide sizing calculations for pipe diameter.
   3. Aluminum Rain Water Leaders shall tie into Cast Iron Pipe.

C.  

2.13 PLUMBING

A. See Division 15

2.14 ELECTRICAL

A. See Division 16
PART 3 EXECUTION

3.01 SITE PREPARATION

A. Site and foundation shall be prepared by design-builder prior to manufacturer's fabrication.

B. Access shall be provided for low-bed trailer and lifting equipment. All overhead wires shall be deactivated and/or temporarily removed.

C. Prior to bidding project, all bidders must visit the site.

3.02 INSTALLATION

A. To minimize impact on its operations SEPTA wishes to minimize the time spent in the field by the contractor:

1. The building should be delivered and placed on the foundation in as few a number of units as is practical.

2. All interior finish work should be factory installed to the greatest extent possible.

3. Field connection, construction, and assembly shall be permitted for those items that cannot be installed at the factory.

4. Field finishing of interior finishes shall be permitted for those items that cannot be installed at the factory.

5. Provide exterior finishes per:

   a. Roofing Systems: Section 07300

   b. Unit Masonry Units: Section 04200

6. The contractor shall install the roof truss modules while maintaining the modular building in a weathertight condition at all times.

3.03 DAILY AND FINAL CLEANUP

A. Keep the site clean and dispose of all debris as directed by the project manager.
B. Prior to final acceptance clean the project thoroughly using a “shop-vac” as needed. Confirm that all temporary window panels are watertight and secure.

END OF SECTION
SECTION 13850
DETECTION AND ALARM

PART 1   GENERAL

1.01   DESCRIPTION
A. This Section includes:
   1. Fire Alarm System control panel, pull station, horn and strobe-light, smoke detectors and system wiring.

1.02   RELATED SECTIONS
A. Section 16050 – Basic Electrical Materials and Methods.
B. Section 16060 – Grounding and Bonding.
C. Section 16070 – Hangers and Supports.
D. Section 16075 – Electrical Identification.
E. Section 16120 – Conductors and Cables.
F. Section 16130 – Raceways and Boxes.
G. Section 16150 – Wiring Connections.

1.03   SUBMITTALS
A. Submit shop drawing for complete system, including all devices. These include but are not limited to: Control panel, sensors, warning light/sign, and wiring.
B. Provide the following information with each shop drawing:
   1. Product Data: Include system ratings, outline dimensions, application limitations, and performance data.
   2. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
1.04 QUALITY ASSURANCE

A. Perform work in accordance with the Township of Levittown Standards.

B. Conform to requirements of ANSI/NFPA 70.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and shown.

D. Perform work in accordance with NECA Standard of Installation.

E. Submit fire alarm plan to FM Global for review prior to starting the work on these components.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle in accordance with manufacturer’s written instructions. Handle panels carefully to avoid damage to internal components.

1.06 OPERATIONAL AND MAINTENANCE DATA

A. Submit operation and maintenance manuals.

1. Include instructions for operating equipment under emergency conditions.

2. Identify operating limits, which may result in hazardous or unsafe conditions.

3. Include recommended preventive maintenance procedures and intervals, special tools, maintenance materials, and a complete replacement parts.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Fire Alarm Systems.

1. Silent Knight – Honeywell.
2. Siemens – Cerberus.


2.02 FIRE ALARM SYSTEM DESCRIPTION

A. The system shall consist of but not limited to the following:

1. Fire Alarm Control Panel (FACP).
   a. The FACP shall monitor the status of all connected devices for fire, wiring fault, incorrect addressing, unauthorized device removal or exchange, pre-alarm condition and contaminated detector conditions.
   b. The FACP shall provide the following common discrete visual indications:
      1) POWER ON green LED indicator
      2) FIRE ALARM dual red LED indicator
      3) TROUBLE yellow LED indicator
      4) SUPERVISORY yellow LED indicator
      5) DISABLED/ISOLATED yellow LED indicator
      6) User Programmable yellow LED indicator
   c. The FACP power supply shall receive 120Vac power from a dedicated fused branch circuit. Upon loss of primary power, the system shall automatically transfer to secondary power. There shall be sufficient battery capacity to operate the entire system for 60 hours during normal standby conditions and 15 minutes during alarm at the end of the standby period.

2. Smoke Detectors.
   a. Ionization smoke detectors that are capable of detecting visible and invisible combustion gasses emanating from fires shall be provided. The ionization detectors shall be
of a dual chamber type to offset the effects of temperature and barometric pressure. A single radioactive source material of less than 1.0 microcurie shall be used as the ionizing source for the air in the detector. The detector shall be fitted with a screen to minimize the effect of small insects.

b. Photoelectric smoke detectors that are capable of detecting visible particles of combustion emanating from fires shall be provided. The photoelectric detectors shall be of light scattering type with an asymmetrical sampling chamber that easily allows smoke to enter while reducing nuisance alarm possibility from dust contamination. The detector shall be fitted with a screen to minimize the effect of small insects.

c. Detector bases shall be of twist lock design and shall be fully interchangeable with ionization and photoelectric detectors.

3. Heat Detectors


a. Manual pull stations shall be of double action type and shall be fabricated of cast metal and finished red with raised-letter-operating instructions of contrasting color.

b. The station shall break a glass rod and mechanically latch upon operation and remain until it is manually reset. The reset key shall be a special tool to prevent unwanted tampering.

5. Combination Audible/Visual Signals.

a. Combination audible/visual signals shall incorporate a Xenon flashtube enclosed in a rugged Lexan lens or equivalent with solid-state circuitry.

b. Strobe shall meet UL 1971 and produce a flash rate of one (1) flash per second minimum over the listed input voltage (20VDC - 31VDC) range.

c. The strobe intensity shall be rated per UL 1971 for 15, 30, 75 or 110 Candela. The 15/75-candela strobe shall
be specified when 15 candela UL 1971 Listing with 75-candela intensity near-axis is required.

B. Provide a detector removal tool that shall attach to an extension pole and provide easy installation of detector heads into the pre-installed base without the need of a ladder.

C. Provide a smoke detector testing tool that shall attach to an extension pole and provide operational testing of the installed smoke detectors without the need to climb a ladder. Canned smoke that is sprayed directly at the detector will not be allowed because they have the potential to leave harmful residues that contribute to degraded operation and the shortened beneficial use of the detector.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer’s recommendations and per AHJ requirements.

B. Store extra materials in Spare Equipment Cabinets.

3.02 FIELD QUALITY CONTROL

A. Test in accordance with manufacturer’s instructions.

3.03 DEMONSTRATION

A. Provide a minimum of two (2) test demonstrations for the system.

END OF SECTION
SECTION 14215

HEAVY-DUTY MACHINE ROOM-LESS PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

A. This Section Includes requirements for the fabrication, installation, and testing of two (2) heavy-duty machine room-less passenger elevators at the locations shown on the Contract Drawings.

1.02 RELATED SECTIONS

A. Division 1: General Requirements
B. Section 01300: Submittals
C. Section 01750: Spare Parts and Maintenance Materials
D. Section 01830: Operations and Maintenance Data
E. Section 04200: Unit Masonry
F. Section 05500: Metal Fabrications
G. Section 05700: Ornamental Metal
H. Section 08110: Metal Doors and Frames
I. Section 08710: Door Hardware
J. Section 08800: Glazing
K. Section 09670: Seamless Quartz Flooring
L. Division 13850: Detection and Alarm
M. Division 15010: Basic Mechanical Requirements
N. Division 15050: Basic Mechanical Materials and Methods
O. Division 16010: Electrical Requirements

1.03 SUBMITTALS

A. Refer to Section 01300, Submittals for additional requirements.
B. Shop Drawings: Complete details of elevator construction and appurtenances including calculations as appropriate showing the following:

1. Dimensional Layout: Complete layout in plan and elevation, showing arrangement of equipment and pertinent details of the elevator, including the following:
   a. Equipment located in the control rooms.
   b. Locations of circuit breakers, switchboard panels, disconnect switches, and feeder extension points in machine rooms.
   c. Outlet locations in hoistways for connection of traveling cable for car lights, fire detectors, communication and control systems.
   d. Car, drive & motors, guide rails, buffers, and other components located in hoistway for each elevator.
   e. Rail bracket spacing and maximum horizontal forces and guide rails in accordance with Rule 200.5 of ASME A17.1.
   f. Reactions at points of support.
   g. Weight of principal parts.
   h. Loads on hoist beams
   i. Maximum loads imposed on racks requiring transfer to building structure.
   j. Top and bottom clearances and overrun travel of elevators.
   k. Provide name of manufacturer of control equipment, together with brochures, technical data, and the location of two (2) elevator applications/installations within thirty (30) miles of the project site.

2. Hoistway Entrances and Doors: Show methods of operation, details of construction, and fastenings to building structure.

3. Elevator Car: Construction details and location of equipment including car lighting, ventilation fans, communications systems, and fastenings.
4. Signaling and Operating System: Details of signaling and operating devices including electronic door detectors, detailing design of indication panels, and identifying graphics.

5. Schematic Wiring Diagram: Complete schematic and functional diagrams of electrical equipment and control wiring. Also provide installation drawings of electrical equipment and control wiring schematic diagrams of elevator system and sub-system indicating interfaces with the building structure.

6. Control Room Equipment Layouts: Provide layout of all elevator components along with mechanical and electrical equipment.

7. Buffers: Details of buffer, including stroke and certified maximum striking speed of car.

C. Product Data: Manufacturer’s catalog cuts, material specifications, warranty, drawings, installation and maintenance instructions, including electronic equipment to control and monitor elevator control functions, and other data pertinent to the components used in the elevator system.

D. Certification: Manufacturer’s certification that all elevator materials and components meet specified requirements.

E. Samples:
   1. 12 inches square pieces of the following:
      a. Stainless Steel
      b. Each type glazing.
      c. Flooring material
      d. Ceiling material.
   2. 12 inches lengths of the following:
      a. Glazing channel and fastening
      b. Stainless steel cab railings.

F. Operation and Maintenance Data:
   1. Operations and Maintenance Manuals: Prior to installation, Contractor shall submit six (6) preliminary sets of operation and maintenance manuals for approval. After SEPTA approval and prior to the beginning of field testing, the Contractor shall provide six (6)
sets of the approved manuals. The manuals and software shall include the following:

a. Table of Contents
b. Equipment and components, descriptive literature including a description of all safety devices.
c. Performance data, model number.
d. Installation instructions.
e. Operating instructions.
f. Maintenance and repair instructions including exploded views of all assemblies and a complete illustrated exploded view for identifying all system parts.
g. Troubleshooting techniques.
h. Spare parts lists and current price list.
i. Lubrication instructions.
j. Detailed, record and as-built layout drawings.
k. Detailed, simplified, as-built, one line, wiring diagrams. Provide one (1) complete set per manual.
l. Field test reports.
m. Complete set of contract software including operating control software.
n. Twelve (12) keys for each new key-operated device that is provided.
o. Diagnostic tools configured to perform at all levels.
p. The Contractor shall provide certification, in writing and signed by an officer of the organization, that SEPTA will be provided with copies of any and all information, correspondence, bulletins, newsletters, manuals, techniques, procedures, drawings, sketches and any other documents related to maintenance, safety, operations, design changes, modifications, retrofits, etc., which relate to any part, component, equipment, system, subsystem or material and services applicable to the elevators provided. All operating, programming, and control software and
licensing keys as applicable to the PLC control system including an open-source, readable copy of the PLC ladder logic code designed for this installation shall be provided.

q. All of the above referenced items shall be provided as it pertains to the original installation and for a period of ten (10) years after final acceptance of the last elevator provided.

r. The elevator manufacturer shall provide the reference material within thirty (30) days of publication or internal distribution. The material, even if labeled PROPRIETARY, shall be delivered to the SEPTA Project Manager without prejudice or delay and at no additional cost.

s. The entire manual shall also be provided in a SEPTA approved electronic format on CD-ROM.

t. Machine Room Prints: Provide complete set of lubrication charts, as-built" field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway as well as the machine room. These diagrams shall be laminated and provided in a watertight stainless steel frame with Lucite cover. Locate in the control room as directed.

u. MSDS and product data sheets: Shall be submitted with an index listing each product, along with the application method of the product, approximate quantity of product per elevator, and the component the product is applied to or associated with.

v. Refer to Section 01830, Operations and Maintenance Data, for additional requirements.

G. Spare Parts List: No later than sixty (60) calendar days from NTP provide the SEPTA Project Manager with five (5) separately bound copies of a recommended spare parts list, include part number, description, quantities, sources and unit prices. Refer to Section 01750, Spare Parts and Maintenance Materials for additional requirements.

H. Spare Parts are to be provided no later than sixty (60) calendar days before the completion of the installations and prior to SEPTA's acceptance. Provide the following spare parts.

1. One (1) complete door operator assembly.

2. One (1) set of disc brakes for each machine.

3. Two (2) sets of car door rollers.
4. Four (4) sets of hoistway door rollers.

5. Two (2) sets of car door gibbs.

6. Four (4) sets of hoistway door gibbs.

7. One (1) set of fuses for each elevator.

8. One (1) electronic door detector for each elevator.

9. One (1) set of each device in the car operating panel.

10. One (1) position indicator for each elevator.

11. Two (2) interlocks for each elevator.

12. One (1) encoder for each elevator.

13. One (1) set of replacement light bulbs for each elevator.

14. One (1) complete set of car and counterweight rollers for each elevator.

I. Interim Maintenance Program: Details of services to be performed and their scheduled frequency; are to be submitted no later than sixty (60) calendar days prior to completion of the installations and prior to SEPTA’s acceptance of installation as specified in Article 1.04-Q. herein.

J. Maintenance Data Reports: After maintenance program is in effect, submit reports as specified in Article 1.04-S herein.

1.04 QUALITY ASSURANCE

A. General:

1. Provide parts built to standard tolerances, dimensions, and clearances so that similar machines and devices are completely interchangeable.

2. On parts of equipment subject to wear and requiring occasional replacement, provide tamper proof key and seat, nut, screws, or other removable and replaceable type mechanical fasteners. Use of rivets or similar type fasteners requiring physical deformation during field positioning will not be permitted.

3. Controller(s) located in elevator control room shall operate within a temperature range of -23 degrees C (-9.4 degrees F) through 40 degrees C (104 degrees F).
B. Elevator System Requirements:

1. Provide elevators complying with ASME A17.1, with rated loads, speeds, and other system requirements as follows:

<table>
<thead>
<tr>
<th>ELEVATORS #1 &amp; #2</th>
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<tr>
<td>Capacity</td>
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<td>Speed</td>
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<td>Travel</td>
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<td>Control</td>
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<tr>
<td>Platform Dimensions</td>
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<td>Cab Inside Clear Dim.</td>
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<td>Entrances</td>
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<tr>
<td>Special Features</td>
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<td>Communications System</td>
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</tbody>
</table>

C. Rated loads exclusive of the complete car weight.

D. Two-way automatic maintaining type leveling device to stop the car at landing with car floor within .25” of the landing floor level, and to correct overtravel or undertravel and maintain the level during loading and unloading.
E. Complete opening and closing of hoistway doors without appreciable
   shock or jar.

F. Hours of Operation: The elevators shall be designed for twenty-four (24)
   hours per day, seven (7) days per week operating capability.

G. Environmental Operation Conditions: Elevators shall operate as specified
   while exposed to the following:

1. From -23 degrees C (-9.4 degrees F) through 40 degrees C (104
   degrees F) dry bulb temperature while exposed to sunlight, rain,
   snow, slush, sleet, airborne dust, and discarded material such as
   newspapers, or lost coins, etc.

2. During installation and until formal written acceptance by the
   SEPTA Project Manager, elevators may be subject to more
   extreme environmental conditions.

   a. Provide the necessary protection to prevent damage or
      deterioration to the elevators during this period.

H. Sound Level Criteria for Elevators and Associated Equipment:

1. Steady-state noise level shall not exceed 55 dBA in public spaces
   when measured 36 inches from the source and within the cab when
   measured 60 inches above the floor.

2. Transient noise level (including elevator door operation) shall not
   exceed 65 dBA in public spaces when measured 36 inches front of
   source, or 75 dBA when measured 36 inches from the elevator
   door or within the cab using the fast meter response.

I. Hoistway Movement: Elevators shall sustain load and operate with
   maximum 1/4-inch lateral movement of hoistway structure.

J. Operational Control: Programmable logic controller (PLC) processor shall
   be field programmable and non-proprietary.

1. Control functions governed are direction of travel, acceleration,
   speed, retardation, starting, and stopping.

2. Provide for normal elevator operation during the hours of that the
   station is open for operation. At all other times the elevator is to be
   lowered to the lowest landing and placed out of service. The
   elevator is return to normal operation when the station is opened.
   This operation is to be automatic and accomplished through the
   elevator control system.
K. Control from Fire Alarm System: Include provisions for the controls to respond to a fire alarm in the elevator hoistway, landings, and/or elevator machine room and to direct the elevator return to the approved main or alternate floor location.

L. Reliability/Maintainability:

1. The Contractor shall maintain each elevator in revenue service at a level of availability of not less than 98% for elevators as calculated using chargeable interruptions as defined in Article 1.04-L.3. For each month that the availability falls below 98% the maintenance and warranty period will be extended one (1) month per occurrence.

2. Down-time and the number of failures that are attributable to mechanical failure or repair activity shall be determined through an analysis of the elevator repair log, on-site inspection and the maintenance and repair log which is maintained for each elevator. The reports and the information utilized in the computation of availability shall be provided by the Contractor monthly to the SEPTA Project Manager. The Contractor shall not be made accountable for downtime generated for reasons beyond the control of the Contractor.

3. SEPTA defines "Failure" as any activity, which causes a Service interruption. Due to the fact that causes of service interruption are varied and not all causes of service interruption can be attributed to the equipment itself, SEPTA shall define service interruptions chargeable to the Contractor as follows:
   a. Unanticipated mechanical disruptions. Non-scheduled maintenance (i.e., replacement of worn components, major overhaul of components, replacements or repairs necessitated by worn or broken components discovered as a result of scheduled
   b. Shutdowns ordered by authorized inspectors due to any unsafe conditions or accidents resulting from mechanical failure or resulting from the Contractor's failure to provide timely repairs as may be cited in an inspector's deficiency report.

4. For service interruptions not specifically addressed in this Section, SEPTA shall have ultimate authority to determine whether the service interruption will be the responsibility of the Contractor.

5. The Contractor shall submit a monthly availability report within five (5) days of the first of the month to the SEPTA Project Manager.
The report shall indicated both the availability as defined by SEPTA; i.e., any and all service interruptions regardless of the cause including scheduled preventive maintenance, and the availability of the elevators considering only the service interruptions chargeable to the Contractor as defined in this Section.

M. Electrical Requirements: Electrical equipment for the elevator shall be designed, selected, and fabricated as specified herein and in the appropriate sections of the Division 16 electrical specifications.

N. Field Testing:
   1. General: After installation and before both acceptance testing and before the date approved for start of interim maintenance, inspect and test the elevators and related equipment to the SEPTA PM’s and the SEPTA Project Manager’s satisfaction that operation of every part of equipment complies with applicable requirements of ASME A17.1 including sound level criteria specified. Elevators shall be inspected in accordance with procedures outlined in ASME A17.2.
      a. Provide test instruments, materials, other necessary facilities, and all labor required for field tests specified.

   2. Notification Requirements:
      a. Notify the SEPTA Project Manager and the SEPTA PM a minimum of five (5) working days prior to each scheduled test. Notify the Commonwealth of Pennsylvania Department of Licensing and Regulation, Division of Labor and Industry, the City of Philadelphia Department of Licenses and Inspections, and the SEPTA PM and the SEPTA Project Manager, a minimum of fifteen (15) calendar days in advance of final field tests.

   3. Full Load Run Test: Run elevator continuously a minimum of one (1) hour with full specified rated load, during which time car shall be stopped at top and bottom landings with a minimum standing period of 10 seconds at each landing.

   4. Speed Test: Make tests before and after full load tests. Using a tachometer on guide rail, determine actual speed of car in both directions of travel, both with full-specified rated load and no load in car. Tolerances for determining if car speeds meet the specified requirements are as follows:
a. Ascending Car Speed: Not more than 10 percent above or more than 10 percent below required speed.

b. Descending Car Speed: Not more than 10 percent above or more than 10 percent below required speed.

5. Car Leveling Test: Determine accuracy of floor landing tests both before and after full load run tests. Test accuracy of landing at all floors with full load and no load in car, in both directions of travel.

6. Electrical Tests: Ensure elevator wiring system is free of short circuits and accidental grounds. Test ground resistance of elevator structure, equipment, and raceways for continuity. Using megohmmeter, determine that insulation resistance of each circuit is one (1) megohm or higher as required by the cable manufacturer. Insulation resistance for motors shall be determined under actual conditions after installation.

7. Temperature Rise Test Motors: Perform this test during full load run test. Start test only when all parts of equipment are within 40°F (5°C) of ambient temperature at time of starting test. Under these conditions, temperature rise of equipment shall not be more than 140°F (60°C) above ambient temperature.

8. Reliability/Maintainability Demonstration Testing: Demonstrate compliance by submitting formal analysis based on verifiable field (customer use) data or by testing.

a. Provide records of the test to include pattern, independent, and dependent failures as defined in MIL-STD-781.

9. Acceptance: Elevator acceptance will be based upon elevators meeting requirements of Contract Documents and upon evidence of passing specified field tests and inspections. Field testing will be conducted after elevators are connected to permanent power.

10. Test Reports: Within five (5) days after completion of a test, submit a test report stating type of test, test requirements, failures, or problems, and name of certifying SEPTA PM and Title to the SEPTA Project Manager. Safety device failure or defective equipment shall be identified, with description of cause and corrective action taken.

11. Certification for operational use shall be accomplished during field testing. The certifying inspector from the enforcing agency shall be present during such testing.
12. The Contractor shall provide the SEPTA Project Manager and the SEPTA PM with a copy of the enforcing agency’s inspection findings within fifteen (15) days after performance of the test.

13. Failures for any reasons shall be identified with cause(s) and corrective action taken.

14. Retest Notification Requirements:
   a. The SEPTA Project Manager shall be notified ten (10) days prior to the scheduled retest.

15. The certificate of inspection for operational use will be issued to SEPTA by the enforcing inspection agency. The certificate shall be posted in the elevator control room.

O. Acceptance Testing

1. Upon completion of all of the field tests and after the operational certificates are issued by the Pennsylvania Department of Labor and Industry the Contractor shall operate the elevator(s) and all maintenance monitor(s) for a period of thirty (30) calendar days. During this thirty (30) day time period, the elevator(s) shall be fully functional and available for public use (other than shut-downs due to passenger caused events or necessary maintenance for a period of up to four (4) hours each.

2. The Contractor shall be on a 24-hour call basis during this thirty (30) day period to respond to any emergencies and breakdowns. The Contractor shall provide 24-hour emergency telephone number(s), name(s) of the person(s) and the firm that will be providing the maintenance and repair services during this period to the SEPTA Project Manager.

3. If any maintenance or repair to the elevator(s) causes the elevator(s) to be unavailable for public service for more than four (4) hours, the thirty (30) day Acceptance Testing period shall be restarted. After the successful completion of the thirty (30) day Acceptance Testing period, SEPTA will establish the date(s) of the beneficial use of the elevator(s) and the start of the one (1) year Warranty and Maintenance program.

4. Acceptance Testing shall be completed consistent with the phasing requirements in the Contract Documents.

P. Warranty:
1. The elevators and associated equipment shall be free of defective material, imperfect work and faulty operation not due to ordinary wear and tear or improper use or care, for a period of one (1) year from successful completion of Acceptance Testing. Defective work shall be repaired or replaced at no additional cost to SEPTA.

2. The warranty does not begin until all of the following requirements have been met.
   
a. The Operations and Maintenance Manuals are accepted by SEPTA.

b. The required training has been completed to the satisfaction of SEPTA.

c. All field tests have been successfully completed.

d. The acceptance testing has been successfully completed.

e. The elevators are in service for passenger/public use.

f. The State and local jurisdictions have inspected the elevators and issued the respective certificates of Operation.

g. All spare parts have been delivered and received by SEPTA.

Q. Maintenance Requirements:

1. The Contractor shall provide full maintenance service as required by the Maintenance Manual prior to SEPTA providing permanent maintenance. This maintenance Work shall commence at final equipment acceptance for each elevator and shall be provided for a period of twelve (12) months of maintenance service during the warranty period, by fully trained elevator mechanics. Maintenance includes preventive maintenance examinations every other week totaling a minimum of two (2) mechanic hours per elevator, per visit (exclusive of repairs and callbacks) for adjustment, greasing, oiling and parts replacement due to normal elevator usage. Provide unlimited regular time and twenty-four (24) hour emergency call back service, including travel time, at no additional cost. Response to regular time callbacks shall be within one (1) hour and for overtime callbacks within two (2) hours.

2. All maintenance activities performed in accordance with the procedures set forth in the approved maintenance manual. Each month, the maintenance Contractor shall submit a written detailed breakdown of all activities occurring in the previous month. In
addition, the reports are to be provided in an electronic format acceptable to SEPTA.

3. Perform work without removing cars from service during peak traffic periods between the hours of 7:30 AM to 9:00 AM and 4:00 PM to 6:00 PM.

4. An entire comprehensive cleandown of the elevator equipment and hoistways are required at the end of the maintenance and warranty period. The Contractor shall obtain, in advance, approval from SEPTA regarding the elevator shutdown time period required to accomplish this work.

5. The Contractor shall assume responsibility and costs for the first annual inspection/cleandown that includes required testing.

a. Reporting: Detailed monthly records of tasks performed including names of individuals performing the tasks, date and time performed, and other pertinent data. The Contractor shall conform to the requirements of SEPTA’s data base maintenance system.

R. Elevators shall not be used in during the construction period for hoisting material or moving personnel.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Products storage and handling requirements.

B. Deliver void forms and installation instructions in manufacturer's packaging.

C. Store off ground in ventilated and protected manner to prevent deterioration from moisture.

1.06 REFERENCES

A. American Federation of Bearing Manufactures Associations (AFBMA):

1. Std. 9 & 11.

B. American Society of Mechanical Engineers (ASME):

2. ASME A17.2 - American standard practice for the inspection of elevators, inspectors manual.
3. ASTM A366 - Steel Sheet, Carbon, Cold-Rolled Commercial Quality.

C. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

D. ASTM International (ASTM):
   1. ASTM A36 - Structural Steel.
   2. ASTM A139 - Electric-Fusion (Arc) - Welded Steel Pipe (Sizes 4 inch and Over).

E. Federal Specifications (FS):
   1. FS TT-P-641 - Primer Coating, Zinc Dust / Zinc Oxide (for galvanized surfaces).
   2. FS TT-P-645 - Primer, Paint, Zinc Chromate, Alkyd Type.

F. Institute of Electrical and Electronics Engineers (IEEE):

G. National Fire Protection Association (NFPA):

H. National Electrical Manufacturers Association (NEMA).

I. Underwriters Laboratories, Incorporated (UL).

J. Any additional requirements imposed by the Authorities Having Jurisdiction (AHJ) shall be incorporated into the elevator installation. Contractor is to secure from the State of Pennsylvania-L&I Elevator Division the required variances for the type of elevator design for the project along with allowing for related piping and wiring of other disciplines within the elevator hoistway. In case of conflict between codes, regulations, or standards, the most stringent shall take precedence.

1.07 DESIGN REQUIREMENTS

A. General
   1. Elevators shall be designed with provisions for thermal expansion and contraction of complete elevator assemblies and for any movement of the facility.
B. Bearings:

1. Bearings shall be rated for an AFBMA L10 life as specified, under a fluctuating bearing load. All bearings shall have basic dynamic load ratings.

C. Fasteners

1. Fasteners shall be compatible with materials being fastened. Fasteners shall be furnished with self locking nuts or retaining rings (spring washers, toothed disks). Fasteners shall be equal to or of greater corrosion resistance than the most corrosion resistant metals being fastened.

1.08 COORDINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Coordinate this Section with other sections of Work, requiring attachment of components to formwork.

1.09 TEMPORARY AND PERMANENT ELECTRICAL POWER SERVICES:

A. For the elevator drive systems: 480 volts, 3 phase, 3 wire, 60 Hertz in a fused disconnect switch within sight of the controller.

B. For lighting and GFCI receptacles: 120 volts, 1 phase, 3 wire, 60 Hertz terminating at the elevator controller location.

C. Separate disconnect for cab lighting and wiring to the elevator cab.

1.10 QUALIFICATIONS

A. Qualifications:

1. Manufacturer: Shall provide documents stating that their firm has successfully produced elevators as designed herein for a minimum of ten (10) years. Acceptable manufacturers include, but are not limited to:

a. Global Tardiff

b. Hollister-Whitney

c. Kone, Inc.

d. Schindler Elevator Corporation
e. SEPTA approved equal.

2. Installer: Manufacturer- and SEPTA-approved installer.


B. Submit manufacturer’s certification of installer approval. Include documentation substantiating experience, union certification and employment record of manufacturer’s or approved installers employees and supervisor assigned to the elevator installation.

C. Submit welder’s certification as specified.

1.11 PROJECT CONDITIONS

A. Protection: During installation and until all elevator systems are fully operational and accepted by SEPTA, make all necessary provisions to protect all elevator components from damage, deterioration, and adverse environmental conditions. Do not use or allow the use of the elevator for construction purposes such as hauling materials or worker transport during construction.

B. Coordination Requirements:

1. Alterations: Contractor shall coordinate with SEPTA any alterations required accommodating the elevators.

2. Floor Finish in Cab: Contractor shall install cab flooring material as specified.

3. Lock and Key Requirements: Contractor shall coordinate with SEPTA.

4. Pit Drainage: Contractor shall coordinate location of sump pits, pumps, pipes, drains, and related wiring with the elevator installer.

5. Rigging Plan: Contractor shall supply a rigging plan that shall be approved by SEPTA prior to the commencement of equipment installation.

6. Safety Training: Contractor shall attend appropriate safety training programs provided by SEPTA at no extra cost.

7. Methodology: The Contractor shall meet with SEPTA and provide a written method of installation for SEPTA’s approval.
8. Electrical: The Contractor shall coordinate all trades regarding the installation of CCTV, communications, smoke detectors, power, and cab lighting requirements.

PART 2 PRODUCTS

2.01 ELEVATOR COMPONENTS

A. Machine: AC gearless machine, with permanent magnet synchronous motor, direct current electro-mechanical disc brakes and integral traction drive sheave. Machine shall be mounted to the car guide rail or support beam mounted at the top of the hoistway.

B. Elevator Drive System

1. Non-Regenerative Variable Voltage Variable Frequency Drive: The drive shall be microprocessor and IGBT based using vector control algorithms. The algorithms shall incorporate a motor model to determine the electromagnetic state of the motor. The motor model shall also encompass a temperature compensation algorithm which is essential for speed accuracy.

2. Velocity shall be controlled by a feedback loop to within +/- 2 percent of specified speed and speed shall be independently supervised.

3. Position of floors in the building shall be learned during a slow speed setup run. Once learned, floor locations shall be stored in non-volatile memory. Power loss shall not require the floors to be re-learned. Stopping accuracy shall be +/- 1/4-inch or less. Re-leveling shall be automatic.

4. Resistors shall be provided to absorb the power regenerated by the motor. They shall dissipate power only when the motor is regenerating. Control shall be by IGBT.

5. Maximum total harmonic distortion shall not exceed IEEE Std. 519 as measured at the elevator disconnect.

C. Suspension Means: If steel core ropes are supplied, a means to provide constant lubrication shall be provided. An alarm indicator shall be provided when the oil reservoir is at 25% of capacity.

D. Dead End Hitch Assemblies: Provide dead end hitch assemblies in accordance with the manufacturer’s loading requirements.
E. Emergency Auxiliary Stop Switch: An enclosed stop switch, mounted in the overhead machine area and/or on the machine of each elevator in accordance with Rule 2.7 of the Code, shall prevent operation of elevator when switch is activated. Switch shall be of the type described in Rule 2.7 of the Code.

F. Counterweight:

1. Counterweights shall consist of a steel frame welded or bolted together and necessary steel weight sections. These weight sections shall be held securely in place within the frame. A minimum of two (2)-tie rods shall pass through the holes in all weight sections and equipped with a counterweight safety. Submit paint finish of counterweights for approval. Paint color selection will be determined by the Architect.
   a. A required counterweight screen where no compensation is used.
   b. The bottom of the counterweight shall have a buffer striking plate and means to attach knock-off blocks during rope stretch.
   c. Idler Sheave: To be located directly above the counterweight frame and integral with counterweight frame. The sheave material shall be accurately machined of semi-steel of hardness BHN 220-250 or as per manufacturer’s requirements.
   d. Roller guides shall be mounted on top and bottom of the counterweight frames to engage the guide rails. Counterweight guides shall be of the roller type; each guide shall consist of a set of three (3) large diameter polyurethane rollers equipped with sealed preloaded ball bearings. Each roller shall be supported by a pivoted rocker arm that shall automatically adjust itself to guide rail misalignment and prevent excessive lateral car movement.

G. A PLC-based controller shall be provided, governing starting and stopping, as well as preventing, damage to the motor from overload or excessive current. It shall automatically cut off the motor current and bring the car to rest in the event any of the safety devices are activated. The controller shall be mounted in a vented NEMA 4X stainless steel air conditioned cabinet within the machine room. The controller shall utilize solid state start control. PLC shall be manufactured by Allen Bradley, Schneider Electric, or SEPTA-approved equal.
1. Selective Collective Operation: As defined by ASME A17.1 and the car button shall be automatically activated to the opposite terminal floor when responding to the designated landing provided the hoistway door interlock and car door switch circuits are completed. Each landing call shall be canceled when answered.

2. The diagnostic system shall be an integral part of the controller and provide user-friendly interaction between the service person and the controls. Controller shall be mounted in a stainless steel NEMA 4X cabinet. The door of the cabinet shall have a sealed window placed over the fault indicator board within.

3. PLC shall remote transfer real operational status via Allen Bradley or Modbus TCP/IP over Ethernet protocol.

H. Provide a separate battery powered unit that senses loss of power. The batteries shall be sealed nickel cadmium or gel cell construction. When loss of power occurs, system shall allow the elevator to make one trip to the landing of choice and open doors automatically. After a predetermined time, the doors shall close and the elevator shall remain inoperative until normal power is restored. The door open button shall operate under battery power.

I. Car frame and Safety: The car safety shall be of integral design with car frame and shall be designed to stop the car should it attain excessive descending speed.

J. Governor: The car and counterweight safeties shall be operated at an integral centrifugal speed governor. The governor shall actuate a switch when excessive speeds occur, disconnecting power to the motor and applying the application of the safety.

K. Hoistway Operating Devices: Terminal stopping devices shall be provided to slow down and stop the car automatically at the terminal landing and to automatically cut off the power and apply the brake, should the car travel beyond the terminal landing.

L. Roller Guides: Roller guides shall be mounted on top and bottom of the car frame.

2.02 EQUIPMENT: HOISTWAY COMPONENTS

A. Car Frame: A suitable car frame shall be provided with adequate bracing to support the platform and car enclosure. The buffer striking plate on the underside of the car-frame platform assembly must fully compress the spring buffer mounted in the pit before the plunger reaches its lower limit of travel. Provide welded or bolted ASTM 123 galvanized steel channel uprights affixed to crosshead and plank channels with welded or bolted
bracing members and gusset plates which will remove strain from car enclosure. Equipment is not to be viewable through the cab glass panels.

B. Platform, Heavy Loading Type: The car platform shall be arranged to accommodate one-piece loads weighing up to 25% of the rated load, such as wheeled food carts, hand trucks, etc. The sub floor surface of the platform is to be 316, No. 4 stainless steel.

C. Spring Buffer: Helical coil spring type.

2.03 WIRING

A. Conduit and Wiring

1. Unless otherwise specified, all electrical conductors in the pits and hoistways, except traveling cable connections to the car shall be provided in rigid galvanized steel conduit with steel outlet boxes, except that a small amount of flexible conduit may be used where conduit is not subject to moisture or embedded in concrete. Terminal boxes pull boxes and other similar items shall be of approved construction, thoroughly reinforced, and in no case less than number 12 USSG. All electrical boxes exceeding 150 cubic inches shall be supported independently of the conduits. The rigid conduit shall conform to the specifications here in before specified. All raceway shall be threaded rigid steel conduit. Flexible heavy-duty service cord, type SO, may be used between fixed car wiring and switches on car doors for door reversal devices.

2. All conduit terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulation bushings. If the bushings are constructed completely of insulation material, a steel locknut shall be installed under the bushing. At ends of conduits not terminating in steel cabinets or boxes, the conductors shall be protected by terminal fittings having an insulated opening for the conductors. All conduits terminating in NEMA 1 boxes shall be backed up with flat rust resistant steel plates to fit the entire area where the conduit penetrated the box.

3. Conduit fittings and connections using set screws or indentations as a means of attachment are not permitted.

4. Connect motors and other components subject to movement or vibration, to the conduit systems with flexible conduit.

5. The Contractor shall furnish all materials and completely wire all parts of the electrical equipment of the elevators including electrical devices on hatch doors.
6. All solid state and electrical components located on top of the car enclosure or in the hoistway shall be installed within NEMA 4 enclosures.

7. The conduits shall be of such size that the wires or cables can be readily installed and replaced, if necessary. No conduit or raceway shall be less than 3/4 inch trade size, except that for small devices such as door switches, interlocks, etc., ½ inch conduit may be used. The total overall cross sectional area of the wires contained in any conduit shall not exceed 40 percent of the internal area of the conduit.

8. Conduits shall be neatly and systematically run. All exposed conduit and boxes shall be supported by approved and substantial straps, hangers or clamps to the structural steel, reinforced concrete, or other approved supports. Riser conduits in hoistway shall be supported at each floor level.

9. All interlock, hall button, and limit switch branch wiring shall be enclosed in flexible steel conduit with covering of liquid tight Type "EF" with connectors having nylon insulated throat.

10. All screws used for terminal connections of all wiring (machine room, hoistway and pit) shall be provided with "star washers" of proper size and type.

B. Conductors:

1. No joints or splices shall be permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

2. All wiring shall test free from short circuits or grounds. Insulation resistance between individual external conductors and between conductors and ground shall be not less than one meg-ohm.

3. Provide all necessary conduit and wiring between the remote control room and hoistway.

C. Traveling Cables:

1. Travel cables shall include separate coaxial cable shielded for the CCTV system.

2. Provide 10 percent spares, but not less than 6 spare conductors in each traveling cable.
3. Provide five (5) pair of shielded wires and two (2) RG-59 type coaxial cables.

4. Provide separate traveling cables for car lighting and fan control circuits.

5. Provide traveling cable for telephone in the elevator car. Cable shall extend from junction box in hoistway to telephone box in car.

6. Provide traveling cable for car work lights.

7. Car junction boxes shall be provided on the top of the elevator cab.

8. All insulated wiring, control wiring and wiring in traveling cables shall be tag coded at their terminals in the motor room or controller location and hoistway junction box, elevator cab junction box, and push-button stations within the cab, and shall agree with the approved wiring diagrams.

D. Car and hall operating signal circuits shall not exceed 48 volts.

2.04 CAB ENCLOSURE

A. Car Top: Car top shall be of stretcher leveled, cabinet grade, and 12 gauge furniture sheet steel, reinforced to support 200 pounds on any one square foot area. An emergency exit shall be installed in the car top in conformance with the Code. Interior surface of car top shall be painted black.

B. Size and detail to withstand design stresses and provide for attachment and support of cladding, housing, ceiling, glass panels, and appurtenances. Paint all members after fabrication. Exterior of car glazing shall be easily accessible for cleaning from within the elevator cab.

C. Suspended Ceiling:

1. 3/4-inch marine grade flame-retardant plywood faced and edged in stainless steel and backed with plastic laminate.

2. Lighting fixture shall be Edison-Price #LL7-COL-PX shallow 3-3/16-inch deep compact fluorescent downlight with 7-inch aperture impact resistant prismatic lens lamp with 2-9W twin tube-Lenslux 7.

D. Interior Walls: Interior walls shall be in accordance with the following:

1. Walls: 9/16-inch clear laminated glass panels in 12 gauge formed stainless steel frames.
2. Glass panels shall be swing design and equipped with the appropriate safety switches that prevent the operation of the elevator when a panel is open. Coordinate glazing requirements with glazing specifications.

3. Provide heavy duty 11 gauge piano hinge with 3/8-inch pin having outside of the knuckle set flush with the outside of each frame.

4. Coordinate locking device requirements with the SEPTA Project Manager.

5. Incorporate stainless steel pad buttons for hanging protection pads. Provide one full set of full-length protection pads.

6. Include one (1) set of solid stainless steel handrails that are 3/8-inch x 2 inches and mounted to removable stainless steel brackets.

7. Stainless steel cove base shall be 6 inches high and to include vents that are equipped with 1/2-inch x 2-inch slots.

8. Stationary returns, transoms, and entrance columns are to be provided in stainless steel.

9. Car Doors: Car doors shall be stainless steel and glass, horizontal side opening sliding type with operator. Doors shall protect the full width and height of car entrance opening when in the fully closed position. Car door frame shall be integral with front wall of cab. Coordinate glazing requirements with glazing specifications.

10. All glass shall be provided with “Vandalshield” protection or SEPTA-approved equal.

11. Flooring: Provide a seamless flooring with integral cove base as in Division 9. Coordinate floor color and finish with SEPTA’s Project Manager.

12. Coordinate the installation of CCTV equipment within the design of the elevator cab as the elevator Contractor is responsible for the installation of the camera and wiring to the control room. Provide assistance to the Electrical Contractor in providing CCTV equipment.

E. Car Door Equipment:

1. Door Hangers: Door hangers for car and hoistway doors shall be of the two point suspension sheave type equipped with grease packed heavy duty precision ball bearings, eccentric up-thrust rollers, and oiler/cleaners. Track shall be of formed cold rolled steel or cold...
drawn steel with rounded track surface to receive sheaves. Track shall be mounted on an eccentric stud to provide for adjustment.

F. Appurtenances:

1. Exhaust Fan: Exhaust fan, mounted on the car top, shall be a two speed, squirrel cage, centrifugal blower type capable of exhausting at least 350/700 CFM and shall conform to the requirements of the Code. Provide sixty (60) minute backup battery power for fan.

2. Car lighting shall provide a minimum of 10-foot candles and shall be of the type shown on the Contract Drawings. Car lighting shall be provided with emergency battery backup upon failure or interruption of normal car lighting. Emergency lighting unit shall provide required lighting for a minimum of four (4) hours. Battery charger shall be capable of restoring battery to full charge within sixteen (16) hours after resumption of normal power. Provide an external means for testing battery, lamps, and alarm bell.

2.05 HOISTWAY ENTRANCES:

A. General:

1. Hoistway entrances shall be of the horizontal sliding type, side opening.

2. Materials and finished surfaces exposed to public view shall be stainless steel and glass.

3. Fascias and other exposed steel parts in the hoistway shall be galvanized steel.

B. Hoistway Frames and Doors:

1. Stainless steel hoistway frames shall be sound deadened and provided with wide profile and operating fixture cutouts as shown on the Contract Drawings.

2. Stainless steel and glass hoistway doors shall be as shown on the Contract Drawings. Hoistway doors shall be reinforced and provided with keyways as required for operating mechanisms and door hangers. Provide glass doors as indicated. Coordinate glazing requirements with glazing specifications. Each door panel shall have laminated phenolic bottom guides that run in landing sill slots.

3. Guides shall be replaceable without removing door panels.

4. Hoistway side of doors shall be galvanized steel.
5. Provide die cast jamb markings (2 per entrance) mounted at 5 feet and flush to the finish surface.

6. Hoistway door hangers and door operator shall be as specified herein.

C. Struts and Closer Support Angles: Hoistway entrances adjacent to non-load bearing walls shall have hanger housing and door closers supported by steel angles of adequate size. Angles shall be continuous between sill and building beams above and shall be bolted to the hanger support. For load bearing walls (masonry, concrete block), submit for SEPTA PM's approval, Shop Drawings of the method to be used to support hanger housing and door closers on the wall.

D. Landing Sills and Guards: Landing sills shall conform to the Code and shall be stainless steel with grooves for door guides machine planed for minimum clearance. Mount sills on steel supports that are anchored to floor construction. Landing sills shall be guarded in accordance with the Code by landing sill guards of 14 gauge steel minimum.

E. Hanger Supports and Cover Plates: Hanger supports shall be 3/16 inch thick steel bolted to strut angles and closer support angles. Hanger cover plates shall be of 14 gauge steel minimum and shall extend the full travel of the doors. Covers shall be made in sections for convenient access when servicing hangers. Hanger sections above door openings shall be removable from within elevator car.

F. Fascia Plate and Dust Cover: Fascia plate and dust cover shall be 14 gauge steel, reinforced as necessary to ensure a flat even surface throughout. Fascia plates and dust covers shall extend the full width of the elevator hoistway to hanger housings and sills above. Toe guard shall be fastened to the sill at the lowest landing. Fascia plates and dust covers shall be galvanized steel.

G. Interlocks and Contacts:

1. The doors at each hoistway entrance shall be equipped with approved hoistway door interlocks of the hoistway unit system type tested as required by the Code.

2. Interlock shall prevent operation of the car away from a landing until doors are locked in the closed position. Interlock shall prevent doors from opening at any landing from the corridor side unless car is at rest at that landing, or is in the leveling zone and stopping at that landing.
3. Hoistway door unlocking devices shall conform to the requirements of the Code and shall be provided to permit authorized persons to gain access to hoistway when car is away from landing.

4. Provide an electric contact mounted on the car that will prevent the car from moving away from landing unless car doors are closed.

H. Sight Guards: Stainless steel to match hoistway entrance finish.

2.06 EQUIPMENT: SIGNAL DEVICES AND FIXTURES

A. General: Provide signal fixtures and control devices for elevator. Buttons and signals shall be tamper resistant of the illuminated type that light-up when activated and remain lit until call or other function has been fulfilled. All signal fixture and control device faceplates shall be of Type 316, 10 gauge stainless steel with AISI No. 4 finish.

1. Car Operating Station:

a. Provide one station in the front return of the elevator.

b. Car operating station shall contain a numbered call button for each landing served, and buttons for DOOR-OPEN, DOOR-CLOSE and EMERGENCY STOP (key type) functions. Buttons shall be tamper resistant stainless steel.

c. Station shall also have a service cabinet for keyed switches of the car light; two-speed exhaust fan, independent operation, inspection operation, two (2) spare key switches, GFI duplex outlet, and jack for sound power intercom.

d. Engrave the car operating panel with the following:

1) No Smoking. Minimum 1 inch high lettering

2) In Case of Fire Do Not Use Elevator

3) Elevator Capacity: Minimum .375 inch high lettering

4) Firefighters Operating Instructions. 1/8 inch high lettering

e. Provide die cast raised markings lettering for the car buttons and car controls in compliance with the "Handicapped Requirements" of ANSI/ASME A17.1. Die cast plates shall be flush with faceplate surface.
f. Provide a top-of-car operating device in compliance with the requirements of the Code. The device shall have control switches for UP, DOWN, OPERATE/INSPECT and EMERGENCY STOP. The device shall also have an 110v ac outlet for extension cord.

g. Emergency Communication Device: Provide integral ADA compliant telephone (Vandal-Proof Products model 1250E). Refer to Section 16720, Telephone and Intercommunications Equipment, for additional requirements.

2. Hall Stations: Riser of hall stations of the push-button, call acknowledging, stainless steel, tamper resistant type shall be recess mounted into the profile face of entrance frame at all elevator landings. Highest landing shall have a single DOWN button. Lowest landing shall have a single UP button. Faceplate finish shall be #4 stainless steel and equipped with Appendix “O”.

3. Car Position Indicator: Car position indicator shall be tamper resistant of the illuminated-signal or digital-display type, complete with an adjustable electronic chime that shall sound when car is stopping or passing a floor served by the elevator. Car position indicator shall be mounted in the car operating station.

4. Car Traveling Lanterns:
   a. Tamper resistant car traveling lanterns shall be equipped with illuminated UP and DOWN signal arrows and mounted in return and strike columns. Provide units projecting from faceplate for ease of angular viewing.
   b. In conjunction with each car traveling lantern, provide an adjustable electronic chime signal to indicate that a car is arriving in response to a hall call and to indicate direction of car travel. Signal shall sound one for up direction of travel and twice for down direction.

5. Bell Alarm System: Bell alarm system for each elevator shall be properly located within building and audible outside hoistway when activated by the EMERGENCY STOP switch or the ALARM call button on each car control station.

6. All signal and operating devices are to be weather resistant and provided with rubber gaskets behind each faceplate.

7. Firefighters' Service System: Firefighters' service system shall be provided in compliance with code requirements.
8. Provide sound powered maintenance intercom system to facilitate the inspection, maintenance and required testing of the elevator systems. System shall consist of the appropriate weatherproof jacks that are wired in parallel. Locate jacks on each cartop, car operating panel and control room. Provide two (2) sound powered telephone headset microphones with extension cords.

2.07 DOOR OPERATOR EQUIPMENT

A. Provide a GAL MOVFR-HSL weather resistant door operator with encoderless VVVF drive and the following features:

1. 1/2 hp motor and heavy duty sprocket, chain, belt, and sheaves.
3. Hand-held keypad programming.
4. Adjustments shall be capable of being stored in the keypad and downloaded to another operator.
5. Adjustable door obstruction reversal.
6. Optical cams with LED indicators.
7. Test switches for open, close, nudging and speed zone set up.
8. Universal inputs for open, close, and nudging.
9. Reversing switch to back up the door reversal device.

B. Door Protection: Electronic Entrance Detector Screen: Provide TriTronics or equal electronic door detector device, which projects an infrared curtain of light guarding the door opening. Arrange to reopen doors if one beam of the curtain is penetrated. Unit shall have transmitters and receivers spaced at a minimum distance to provide the maximum amount of protection within the height of the doorway. Systems, which have the availability to turn Off or On individual zones within the curtain, will not be allowed.

C. No door operating equipment shall be viewable through the glass hoistway and car door panels.
PART 3 EXECUTION

3.01 EXAMINATION

A. **Section 01300 - Administrative Requirements**: Coordination and project conditions.

B. Verify lines, levels, and centers before proceeding with installations. Verify dimensions agree with Drawings.

3.02 ADJUSTING AND CLEANING

A. All equipment shall be adjusted prior to final testing and acceptance.

B. Restore or replace exposed work soiled or damaged during installation.

3.03 TRAINING

A. Duration: The Contractor shall prepare and conduct a maintenance training program on SEPTA premises consisting of two classes each of 20 hours, for a total duration of 40 class hours. Each of the two classes shall consist of up to 10 SEPTA maintenance mechanics.

B. Training Subjects: Submit for approval, within sixty (60) days of Notice To Proceed, instructions that shall include, as a minimum: up-to-date elevator operation principles; systematic maintenance operations; trouble shooting, repair techniques; interpreting diagrams, blueprints, schematics and maintenance directives. At the conclusion of the training, Contractor shall furnish to SEPTA, one complete set of lesson plans, classroom notes and all other materials used in presenting the course.

C. Refer to **Section 01820, Demonstration and Training**, for additional requirements.

END OF SECTION
SECTION 15010
MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. All sections of Division 1.

B. Examine all drawings and all other Sections of the Specifications for requirements therein affecting the work of this Section. Work shall be coordinated with other trades prior to installation to prevent interference and relocations.

1.02 SUMMARY

A. This section includes general administrative and procedural requirements for mechanical installations. The following administrative and procedural requirements are included in this section to expand the requirements specified in Division 1:

1. Submittals.

2. Record documents.


4. Rough-ins.

5. Mechanical installations.

6. Cutting and patching.

1.03 RELATED SECTIONS

A. The following sections contain requirements that relate to this section:

1. Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS," for materials and methods common to the remainder of Division 15, plus general related specifications including:

   a. Access to mechanical installations.

   b. Excavation for mechanical installations within the building boundaries, and from building to utilities.
connections.

1.04 SUBMITTALS

A. General: Follow the procedures specified in Division 1, Section "SUBMITTALS."

B. Submit the number of mechanical related shop drawings, product data, and samples as listed below:

1. Shop Drawings: 8 copies of each item.

2. Product Data: 8 copies of each item.

3. Samples: See individual specification sections.

C. Increase, by the quantity listed below, the number of mechanical related shop drawings, product data, and samples submitted, to allow for required distribution plus one copy of each submittal required which will be retained by the Mechanical Consulting Engineer.

1. Shop Drawings - Initial Submittal: 1 additional blue-or black-line prints.

2. Shop Drawings - Final Submittal: 1 additional blue-or black-line prints.

3. Product Data: 1 additional copy of each item.

D. Additional copies may be required by individual sections of these specifications.

1.05 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements in Division 1 Section "PROJECT RECORD DOCUMENTS." In addition to the requirements specified in Division 1, indicate the following installed conditions:

1. Ductwork mains and branches, size and location, for both exterior and interior; locations of dampers and other control devices; filters, boxes, and terminal units requiring periodic maintenance or repair.

2. Mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e.,
traps, strainers, expansion compensators, tanks, etc.). Valve location diagrams, complete with valve tag chart. Refer to Division 15 Section "Mechanical Identification." Indicate actual inverts and horizontal locations of underground piping.

3. Equipment locations (exposed and concealed), dimensioned from prominent building lines.


5. Contract Modifications, actual equipment and materials installed.

1.06 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Division 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in Division 1, include the following information for equipment items:

1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.

3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

4. Servicing instructions and lubrication charts and schedules.

B. Upon completion of the work, and as a condition of its acceptance, deliver to the SEPTA PM three (3) copies of a manual describing the system. Prepare manuals in durable plastic binders approximately 8½" x 11" in size with at least the following:

1. Identification on or readable through, the front cover stating the general nature of the manual.

2. A listing of Names, addresses, and phone numbers of the Contractor and all subcontractors.
3. Neatly typewritten index near the front of the manual, furnishing immediate information as to the location in the manual of all data regarding the installation.

4. A copy of all reviewed submittals and shop drawings.

5. A simplified description of the operation of all systems including the function of each piece of equipment within each system. These descriptions shall be supported with a schematic flow diagram.

6. Description of function, normal operating characteristics and limitations, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.

7. An explanation of the control sequence of each system along with the following instructions wherever applicable:
   a. Emergency procedures for fire or failure of major equipment.
   b. Normal starting, operation and shutdown.
   c. Summer/Winter shutdown or switchover.

8. Manufacturer’s printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions.

9. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.

10. An outline of a preventive maintenance program for each item which shall include a schedule of inspection and maintenance. It shall suggest the maintenance and inspection that should be done with outside service.

11. Servicing instructions and lubrication charts and schedules.

12. Complete name and address of nearest vendor of replaceable parts.

13. Copy of all guarantees and warranties issued.

14. Where contents of the manual include manufacturer's catalog pages, clearly indicate the precise items included in this
installation and delete, or otherwise clearly indicate, all manufacturer's data with which this installation is not concerned.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, and other information needed for identification.

B. Contractor and his subcontractors shall be responsible for the transportation and handling of all materials from, to, and at the project site. All damages thereto shall be replaced by the responsible party at no additional cost to the Owner.

C. Properly identify all materials shipped to the Contractor at the project site with the Contractor's name, project title, and specific delivery point. Receipt of materials is the Contractor's responsibility.

PART 2 PRODUCTS - Not Applicable

PART 3 EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 15 and 16 for rough-in requirements.

3.02 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of mechanical systems, materials, and equipment. Comply with the following requirements:

1. Coordinate mechanical systems, equipment, and materials installation with other building components.

2. Verify all dimensions by field measurements.

3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for mechanical installations.

4. Coordinate the installation of required supporting devices and
sleeves to be set in poured-in-place concrete and other structural components, as they are constructed or as they exist.

5. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing in the building.

6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

7. Coordinate connection of mechanical systems with exterior underground utilities and services. Provide required connection for each service.

8. Install systems, materials, and equipment to conform with approved submittal data to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the SEPTA PM.

9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.

10. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

11. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in Division 15 Section "BASIC MECHANICAL MATERIALS AND METHODS".

### 3.03 ACCESS PANELS

A. This Subcontractor shall furnish all access panels necessary to his work in concealed spaces and of the correct size needed to maintain his work. The minimum size of access panels shall be 12"x 12". These access panels shall be compatible to the type of construction where they will be installed.
B. Access panels shall be similar to those manufactured by Inland Steel Products Company, L.M. Walsh Company Babcock-Davis Associates, Inc., Williams Brothers Corporation of America or equal.

1. Install systems, material, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

3.04 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with Division 1 Section "CUTTING AND PATCHING." In addition to the requirements specified in Division 1, the following requirements apply:

1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of mechanical equipment and materials required to:

1. Uncover work to provide for installation of ill-timed work.
2. Remove and replace defective work.
3. Remove and replace work not conforming to requirements of the Contract Documents.
4. Remove samples of installed work as specified for testing.
5. Install equipment and materials in existing structures.
6. Upon written instructions from the SEPTA PM, uncover and restore work to provide for SEPTA PM's observation of concealed work.

C. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.

D. Cut, remove, and legally dispose of selected mechanical equipment, components, and materials as indicated, including but not limited to removal of mechanical piping, heating units, and other mechanical items made obsolete by the new work.

E. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

F. Provide and maintain temporary partitions or dust barriers adequate
to prevent the spread of dust and dirt to adjacent areas.

1. Patch existing finished surfaces and building components using new materials matching existing materials and experienced installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

2. Patch finished surfaces and building components using new materials specified for the original installation and experienced Installers. Installers' qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION
SECTION 15050
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes the following:
   1. Basic materials and methods for piping systems.

B. Related Sections:
   1. Division 2 - Site Work.
   2. Mechanical Requirements: Section 15010.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A13.1; Scheme for the Identification of Piping Systems.
   2. ANSI A21.10; Ductile-Iron and Gray-Iron Fittings, 3 through 48 in, for Water and Other Liquids.
   3. ANSI A21.50; Thickness Design of Ductile-Iron Pipe.
   4. ANSI A21.51; Ductile-Iron Pipe, Centrifugally Cast, in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
   5. ANSI B2.1; Pipe Threads.
   6. ANSI B16.1; Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800.
   7. ANSI B16.3; Malleable Iron Screwed Fittings Class 150 and 300 lb.
   8. ANSI B16.4; Cast Iron Threaded Fittings Class 125 and 250 lb.
   9. ANSI B16.18; Cast Copper Alloy Solder Joint Pressure Fittings.
   10. ANSI B16.21; Nonmetallic Flat Gaskets for Pipe Flanges.
11. ANSI B16.22; Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.

B. American Society for Testing and Materials (ASTM):

1. ASTM A 47; Specification for Malleable Iron Castings.
2. ASTM A 53; Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
3. ASTM A 74; Specification for Cast Iron Soil Pipe and Fittings.
5. ASTM A 153; Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
6. ASTM A 181; Specification for Forgings, Carbon Steel, for General-Purpose Piping.
7. ASTM A 183; Specification for Heat-Treated Carbon Steel Track Bolts and Nuts.
8. ASTM A 278; Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 Degrees F (345 Degrees C).
10. ASTM A 536; Specification for Ductile Iron Castings.
11. ASTM B 32; Specification for Solder Metal.
12. ASTM B 62; Specification for Composition Bronze or Ounce Metal Castings.
13. ASTM B 88; Specification for Seamless Copper Water Tube.
14. ASTM B 584; Specification for Copper Alloy Sand Castings for General Applications.
15. ASTM C 564; Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
16. ASTM D 1785; Specification for Poly(Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40.80 and 120.
17. ASTM D 2000; Classification for Rubber Products in Automotive Applications.


C. Federal Specifications (Fed. Spec.):
   1. Fed. Spec. QQ-C-40; Calking: Lead Wool and Lead Pig.

D. Manufacturer's Standardization Society (MSS) of the Valve and Fittings Industry, MSS-SP-70 and MSS-SP-71.

1.03 SUBMITTALS

A. Product Data: As specified in Section 15010; submittals required for the following items:
   1. Valves (and Cocks).
   2. Mechanical Pipe Couplings.
   3. Pipe and Fittings.
   4. Pipe Identification and Valve Marking System.
   5. Meters and Gages.

PART 2 PRODUCTS

2.01 BASIC MATERIAL REQUIREMENTS

A. Acceptable Manufacturers: In the following Piping System Specifications product manufacturers are specified for certain items. By naming such manufacturers no intent is implied to eliminate from consideration equivalent products made by other manufacturers.

B. Valves, General Requirements: Provide valves of the same basic
type, by the same product manufacturer, except where specifically specified otherwise. Each valve shall bear manufacturer's trademark, flow direction indication, and reference symbol indicating conditions for which it is guaranteed. Provide valves of 125 PSI pressure rating minimum and temperature rating of not less than the design criteria as applicable to the pipe system components.

1. Bronze Valves: Provide valves with pressure containing parts of materials of minimum physical properties in accordance with the specified Reference Standards.

2. Iron and/or Steel Body Valves: Provide valves conforming to ANSI B16.10 for face-to-face and end-to-end dimensions. Valve design, quality, materials and testing shall conform to MSS-SP-70 and MSS-SP-71; with pressure containing parts also of materials of minimum physical properties in accordance with the specified Reference Standards.

3. Gate Valves: Provide valves designed for repacking under pressure when fully opened, and equipped with packing suitable for the intended service. When the valve is fully opened, the back seal shall protect both packing and stem threads from the fluid.

4. Acceptable Manufacturers:
   a. Nibco Inc.
   b. Milwaukee Valve Company, Inc.
   c. Stockham Valves & Fittings.
   d. Or equal

C. Pipe Line Support Materials: As specified in Section 15060.

D. Pipe Identification and Valve Marking Materials:

1. Pipe System Identification: Provide a color coded system of pipe identification in accordance with ANSI Standard A13.1, Scheme for the identification of Piping Systems, for the various piping systems as specified. Color Code as indicated in Piping System Specifications.
   a. Pipe identification shall consist of two continuous bands of directional flow arrow tape placed around the pipe
and shall contain within their boundaries a pipe legend identifying the service as specified herein. Provide both the directional arrow bands and pipe legends in the same color coding. Both wordings and background colors shall conform to above referenced ANSI Standard.

b. Acceptable Manufacturers:

1) W. H. Brady Company, Signmark Division; System 1/ Self-Sticking Pipe Markers and Directional Flow Arrow Tape.

2) Seton Name Plate Company.

3) Or equal

2. Valve Identification Tags: Provide color coded valve tags to match color coding of piping system in which valves are installed.


b. Provide a valve tag chart, neatly type, which shall explain what each numbered valve controls. Mount valve tag chart in an extruded, clear anodized aluminum frame with a clear plastic window. Minimum size of valve tag chart at 8½ x 11-inches.

c. Acceptable Manufacturers:

1) W. H. Brady Company, Signmark Division; Valve Tags & Checks.

2) Seton Name Plate Company.

3) Or equal

3. Locations: Locate piping system identifications a minimum of one place per room and not over 25-feet apart in any room. Provide valve tags for each valve in each identified system with numbers running consecutively beginning at the source of each system.

END OF SECTION
SECTION 15060

HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes the following:
   1. Services and work of an administrative nature as well as general requirements concerning certain products and operations, all common to the entire Division 15 Sections.

B. Related Sections:
   1. Division 15 Sections as Included.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI B31.1, Code for Pressure Piping.

B. American Society For Testing and Materials (ASTM):
   1. ASTM A 36; Specification for Structural Steel.
   2. ASTM A 47; Specification for Ferritic Malleable Iron Castings.
   3. ASTM A 48; Specification for Gray Iron Castings.
   4. ASTM A 53; Specification for Pipe, Steel, Black and Hot-Dipped Zinc-Coated Welded and Seamless.
   5. ASTM A 167; Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
   6. ASTM A 181; Specification for Forgings, Carbon Steel, for General-Purpose Piping.
   8. ASTM A 320; Specification for Alloy Steel Bolting Materials for Low-Temperature Service.
   9. ASTM A 563; Specification for Carbon and Alloy Steel Nuts.

11. ASTM B 695; Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.

12. ASTM D635; Test Method for Rate of Burning and/or extent and time of Burning of Plastics in a Horizontal Position.

C. American Welding Society (AWS): AWS D1.1 Structural Welding Code.

D. International Building Code

E. International Mechanical Code


G. Federal Specifications (Fed. Spec.):
   1. Fed. Spec. FF-S-325, Shield, Expansion; Nail, Expansion and Nail Drive Screw (Devices, Anchoring, Masonry) Group II (Shield, Expansion Bolt Anchor) Type 4 (Wedge Expansion Anchors) Class 1 (One-Piece Steel Expander with Cone Taper Integral with Stud).

H. Manufacturer's Standardization Society (MSS) of the Valve and Fittings Industry:
   1. MSS SP-58, Pipe Hangers and Supports - Materials, Design and Manufacturer.
   2. MSS SP-69, Pipe Hangers and Supports - Selection and Application.

I. Sheet Metal and Air-Conditioning Contractors' National Association, Inc. (SMACNA):
   1. SMACNA HVAC Duct Construction Standards, Metal and Flexible.
J. Underwriters’ Laboratories, Inc. (UL) Listings and Labels shall govern the quality and performance of certain Products as specified herein.

1.03 SUBMITTALS

A. Product Data: As specified; submittals required for the following items:

1. Pipe Supports.
2. Guides, Anchors and Expansion Joints.
3. Anchors and Fasteners.
4. Sleeves and Seals.

B. Shop Drawings: As specified in Section 15000; shop drawings required for the following:

1. Submit completely dimensioned shop drawings of piping layouts; indicating the type, design and location of pipe hangers, supports, anchors and guides required for piping installation.
2. Submit completely dimensioned shop drawings of duct layouts indicating hanger and support locations.
3. Submit completely dimensioned shop drawings of equipment suspension and support systems, including sizing of anchors and fasteners.

1.04 QUALITY ASSURANCE

A. Design Criteria:

1. Pipe Support Systems: Provide adequate pipe support systems designed in accordance with recognized engineering practices using, where possible, standard, commercially accepted pipe hangers and accessories.

   a. Pipe hangers and supports shall conform to the latest requirements of ANSI B31.1., MSS SP-58, MSS SP-69, and other requirements specified herein.

2. Duct Support Systems: Provide adequate duct suspension and support systems designed in accordance with SMACNA
HVAC standards except for restrictions and other requirements as specified herein.

3. Equipment Support Systems: Provide adequate equipment suspension systems and base supports designed in accordance with recognized engineering practices using, where possible, standard commercially accepted products and systems.

   a. Design and size equipment suspension systems and base supports units based on installation instruction or information as obtained from equipment manufacturers and other requirements as specified herein.

B. Anchor and Fastener Design Requirements:

1. Sizing: Provide anchors and fasteners for Product installations of such diameters and lengths as recommended by the particular Product manufacturer involved.

   a. When sizing recommendations are not obtainable, size fasteners in the largest diameter that will pass through bolt holes as provided in the Products for anchoring and fastening purposes.

2. Safety Factor: Determine the lengths of anchors and fasteners based on substrate materials at points of anchor installation and to provide a safety factor of four to one.

3. Materials Compatibility: Where pipe supports contact bare piping or in-line devices, provide supports of compatible material so that neither will have a deteriorating action on the other.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete Inserts: For upper attachments in cast-in-place concrete structures provide cast-in inserts made of galvanized steel.

   1. Where attached loads exceed the recommended load for an individual insert, provide multiple inserts with a trapeze type connecting member below the concrete.
B. Beam Clamps: For upper attachments on structural steel provide beam clamps of carbon steel ASTM A 36 or forged steel ASTM A 181.

1. Holes drilled in structural steel for hanger support rods will not be permitted.

2. Provide clamps with hardened steel cup-point set screw and lock-nut for anchoring in place.

3. Base clamp size selection on required load being supported.

C. Hanger Rods: Galvanized Steel.

D. Diameter of rods for piping system support shall conform to ANSI B31.1.

1. In no case shall hanger rods less than 3/8-inch diameter be provided for support of pipe sizes two inches and smaller, or less than 1/2-inch diameter rod for supporting pipe sizes 2-1/2-inch and larger.

2. Size hanger rods for duct work systems in accordance with SMACNA standards.

3. Size hanger rods for mechanical equipment support based on installation instructions as obtained from equipment manufacturers.

   a. All-thread hanger rods not permitted for equipment supports.

E. Auxiliary Steel: Provide auxiliary steel where support of piping systems and equipment is required between building structural elements. Provide light gauge and structural steel shapes conform to requirements of ASTM A 36.

1. Contractor shall have the option to use pre-engineered support systems of electrogalvanized steel products such as Kindorf, UniStrut or B-Line. MIXTURE OF SUPPORT SYSTEM MANUFACTURER’S PRODUCTS NOT PERMITTED.

2. Where auxiliary steel is indicated as stainless steel, provide AISI Type 304 stainless steel conforming to ASTM A 167, in No. 1 Finish.
2.02 PIPE SUPPORTS

A. Base Supports: Where base supports are indicated for valves and pipe fittings provide saddles supported by pipe columns.

1. Saddles: Consisting of devices similar to ITT Grinnell Figure 258 Cast Iron Pipe Saddle Support; and pipe column designed to adequately support the applied loads with a steel base anchored to floor.


3. Riser Clamps: Support vertical runs of piping at each floor, or closer where required, with carbon steel clamps ASTM A 36 bolted around pipes and attached to the building construction.

4. Provide copper plated clamps for copper tubing support.

5. Provide two bolt type clamps designed for installation under insulation on insulated pipe runs.

B. Offset Pipe Clamp: Where pipes are indicated as offset from wall surfaces, provide double-leg design two-piece pipe clamp similar to Figure 366 by Fee & Mason. Clamp material as indicated on the Drawings.

C. Hangers: Fabricated of malleable iron ASTM A 47, or carbon steel ASTM A 36.

D. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

1. Hangers for pipe sizes 2-1/2-inches or larger shall incorporate a means of vertical adjustment after erection while supporting the load.

2. Adjustable Band Hangers: Carbon steel band type hangers designed for suspension on hanger rods with provisions for vertical adjustments and locking in position using supporting and locknuts. Provide band hangers to support non-insulated pipe.

3. Clevis Hangers for Non-Insulated Pipe: Carbon steel yoke and U-strap type with cross bolt over pipe.
4. Clevis Hangers for Insulated Pipe: Carbon steel yoke and U-strap type hanger designed for installation under insulation with cross bolt outside the insulation.

5. UL and NFPA Approved Hangers: Clevis type, adjustable swivel type, or adjustable flat-iron type. Where adjustable flat iron hangers cannot be used, hangers may be universal channel type or C-type with retaining strap.

E. Brackets: Where piping is run adjacent to walls or steel columns, provide welded steel brackets ASTM A 36 and pre-punched with a minimum of two fastener holes.

F. Racks: Multiple pipe racks or trapeze hangers fabricated from steel ASTM A 36, and designed to suit conditions at points of installation.

1. Keep pipes in their relative positions to each other by the use of clamps or clips. Lines subject to thermal expansion must be free to slide or roll.

G. Pipe Anchors, Guides and Sliding Supports (For Heating System Piping):

1. Anchors fabricated from carbon steel, ASTM A 36.

2. Guides fabricated from carbon steel, ASTM A 36, or cast iron, ASTM A 48.


4. Provide anchors, guides and supports where necessary to keep pipes in accurate alignment, to direct the expansion movement and to prevent buckling and swaying and undue strain.

2.03 ANCHORS AND FASTENERS

A. Anchor Bolts (Pre-Set): Where anchor bolts are indicated or required as pre-set in cast-in-place concrete, provide anchor bolts of lug or bent shape design.

1. Stainless Steel Bolts: ASTM A 320, Grade B8, AISC Type 303 or 304.

B. Drilled-In Expansion Anchors and Fasteners:
1. Applications In Masonry (and Precast Concrete Hollow-Core Structural Elements):

   a. Anchors: Provide anchors designed to accept both machine bolts and/or threaded rods. Such anchors shall consist of an expansion shield and expander nut contained inside the shield. Expander nut fabricated and designed to climb the bolt or rod thread and simultaneously expand the shield as soon as the threaded item, while being tightened, reaches and bears against the shield bottom.

      (1) Shield Body: Consisting of four legs, the inside of each tapered toward shield bottom (or nut end). The end of one leg is elongated and turned across shield bottom. Outer surface of shield body ribbed for grip-action.

      (2) Expander Nut: Square design with sides tapered inward from bottom to top.

      (3) Material: Die cast Zamac No. 3 zinc alloy of 43,000 psi minimum tensile strength. Shield and nut made in conformance with S.A.E. 90 3 ASTM XI.

   b. Fasteners: Machine bolts conforming to S.A.E. Grade 2, for use with above anchors; nuts and washers conforming to ASTM A 563.

   c. Acceptable Manufacturers:

      (1) U.S.E. Diamond, Inc.; FORWAY System.

      (2) Or Approved Equal.

2. Applications in Cast-in-Place Concrete (and Solid Precast Concrete Structural Elements):

   a. Anchor/Fastener: UL Listed and one-piece stud (bolt) with integral expansion wedges, nut and washer, and meeting physical requirements of Fed. Spec. FF-S-325, Group II, Type 4, Class 1.

   b. Stainless Steel Anchor/Fastener: UL Listed one-piece stud (bolt) with integral expansion wedges, nut and washer, and meeting physical requirements of Fed.
Spec. FF-S-325, Group II, Type 4, Class 1. Stud of AISI Type 303 or 304 stainless and nut and washer of AISI Type 316 stainless.

c. Acceptable Manufacturers:

(3) U.S.E. Diamond, Inc.; SUP-R-STUD.

(4) Hilti Fastening Systems; KWIK-BOLT.

(5) Molly Fastener Group; PARABOLT.

(6) Phillips; RED HEAD Wedge-Anchor.

(7) Or Approved Equal.

3. Applications in Horizontal (Floor Mounted) for Adhesive Anchors: Composed of an anchor rod assembly and an anchor rod adhesive cartridge.


b. Stainless Steel Anchor Rod Assembly: Chamfered and threaded stud rod of AISI Type 304 stainless with nut and washer of AISI Type 316 stainless.

c. Adhesive Cartridge: Sealed capsule containing premeasured amounts of resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. Capsule ingredients activated by the insertion procedure of the anchor rod assembly.

d. Acceptable Manufacturers:

(1) U.S.E. Diamond, Inc.; SUP-R-SET.

(2) Hilti Fastening Systems; HVA.

(3) Molly Fastener Group: PARABOND.

(4) Or Approved Equal.

(5) Note: Hammer drive-type and explosive charge drive-type anchors and fastener systems not acceptable. Lead shields, plastic-inserts, fiber-
inserts, and drilled-in plastic sleeve/nail drive systems also not acceptable.

C. Welding Electrodes: Table 4.1.1 of AWS D1.1 as required for applicable base metals and welding process.

2.04 SLEEVES AND SEALS

A. Pipe Sleeve Sizing:

1. Uninsulated Pipes: Size sleeves two pipe sizes larger than pipe passing through, or size sleeves for a minimum of 1/2-inch clearance between inside of sleeve and outside diameter of pipe passing through.

2. Wall Seal Sleeve: Size sleeves to accommodate the pipe plus the hydrostatic Wall Seal.

3. Insulated Pipes: Size sleeves for a minimum of 1/2-inch clearance between inside of sleeve and outside diameter of insulation covering on pipes passing through.

4. Sleeve Length:

a. Wall and Partitions: Equal to total thickness of wall or partitions and terminated flush with finished surfaces.

b. Floors: Equal to total depth of floor construction including finish and extending a minimum of one inch above floor level.

B. Sleeve Materials:

1. Pipe Sleeves In Cast-In-Place Concrete: Fabricate from Schedule 10 black steel pipe and weld a 2-inch wide intermediate anchoring flange of 3/16-inch steel midway on pipe sleeve; or provide sleeve as furnished by wall seal manufacturer.

2. Pipe Sleeves In Masonry: No. 18 gauge galvanized sheet steel.

3. Pipe Sleeves In Wallboard Partitions: No. 18 gauge galvanized sheet steel with anchoring flanges or tabs.

4. Wall Pipe: Cast iron construction with an integral intermediate anchoring flange midway on the pipe exterior.
5. Wall pipe ends of type indicated on Drawings, and where not indicated, pipe end shall match that of adjoining pipe.

6. Provide wall pipes similar to those manufactured by Clow Corporation, American Cast Iron Pipe Co., U.S. Pipe and Foundry Co., or approved equal.

C. Foundation Sleeves: ((Use only when pipe in sleeve must expand)) Gray or ductile cast iron with intermediate wall collar anchor and cutting grooves on the plain end.

1. Sleeve designed for mechanical joint gasket and gland and furnished with such. Sleeve designed to pass pipes through interior dimension of sleeve.

2. Provide sleeves similar to those manufactured by Clow Corporation, MJ Wall Sleeve F-1429, or approved equal.

D. Seals and Plates:

1. Wall Seal: Hydrostatic modular compression link seal designed to seal opening between pipes and a through structure opening. Provide Link-Seal by Thunderline Corp., or equal. Caulking, mastic sealants, lead/oakum, continuous (solid) gaskets are not acceptable as equal.

2. Wall and Ceiling Plates: Cast metal with integral set screw or similar anchoring screw. Hinged or split design plates may be provided.

3. Escutcheons: Provide chrome plated stamped steel hinged plates to close pipe penetrations through structure interior in finished areas. Provide plates designed to lock on pipes using set screws.

E. Fire Seals: See Specification Section 07270 - Firestopping.

F. Pre-Fabricated Roof Penetration Seal: Provide a factory pre-fabricated system of materials acceptable to or by the existing roofing system membrane manufacturer.

1. The pre-fabricated system design shall accommodate multiple pipes and conduits in a single fabricated curb and EPDM pipe portal unit.

2. Acceptable manufacturers:
1. Install pipe supports and anchors to hold piping straight and true to line both vertically and horizontally.

2. Where thermal movement in piping systems will occur, provide piping system supports capable of supporting the line in all operating conditions.

3. The supporting force at each hanger shall prevent excessive stress in the pipe and connected equipment.

4. Install pipe supports anchored directly to or suspended directly from structural supports. Where pipe hangers fall between structural members provide auxiliary steel supports to carry pipe hangers.

5. Do not support piping from metal decks.

B. Spacing of Hangers and Supports:

1. General:
   
a. Space hangers and supports as stated herein and in ANSI B31.1, MSS SP 58 and SP 69, and as indicated on the Drawings.

b. Give special consideration to spacing of hangers and supports where components such as fittings and valves impose concentrated loads.

2. Cast Iron Soil Pipe: Space hangers on horizontal runs of Cast Iron Soil Pipe according to CISPI 301.

C. Plastic Piping: Provide hangers at locations and spacing limitations in accordance with pipe manufacturer's installation specifications.
D. Pipe Sleeve Installation:

1. Set pipe sleeves in concrete formwork, walls, partitions, floors and ceilings as construction work progresses. Provide sleeve for each pipe individually.

2. Provide and set sleeves to avoid delaying construction activities of other trades. Perform any additional cutting and boring required due to improperly located or omitted openings without cost to the Owner and perform such additional work under the observation of the Project Manager.

E. Equipment Supports and Penetrations Seals for Materials and Equipment Exposed to Weather: Provide stainless steel fasteners for both exposed and concealed attachments in exterior locations.

F. Seals and Plates Installation:

1. Following pipe installation through sleeves in exterior walls below grade, install Wall Seal to render installation leak free. Wall Seal not required in interior walls, partitions, floor and ceilings.

2. Install wall seal as close to outside surface of wall as possible to provide a watertight seal below grade. Apply a coating of coal tar paint or other type approved coating on bolt heads and other metal parts on below grade wall seals prior to backfilling.

3. Install wall and ceiling plates to close pipe sleeve openings.

4. Install escutcheons to close pipe sleeve openings in finished areas.

G. Installation In Warranted Roofing System: Perform roof work associated with the equipment support and penetration seal installations, either by using the installing contractor of record for the existing roofing; or by using a qualified installer as qualified by the manufacturer of the existing roofing system manufacturer.

1. Submit evidence of acceptability as a qualified installer of the roofing system manufacturer.

2. Provide the Owner with written conformation from the roofing system manufacturer that the roof penetration work was
performed in accordance with the original warranty requirements, and that the warranty remains intact.

H. Fire Seals Installation:

1. Following pipe installation through sleeves in fire-rated walls or partitions and floors install either compound type or mechanical seal, as prior approved.

2. Install seal materials in accordance with manufacturer's installation instructions.

3. Install Escutcheons on pipes passing through sleeves in finished locations.

I. Wall Pipe Installations:

1. Provide wall pipes for those installations indicated on the Drawings where piping is cast integrally into the structure.

2. Provide wall pipes with joining ends as match or mate with those of pipes being connected.

3. Provide the proper gaskets, bolts, nuts and washers as required in the pipe joining to wall pipes.

J. Existing Structure Penetrations:

1. Make existing masonry and concrete structure penetrations for piping by the core-drilling method. Make such penetrations true, clean and free from spalling.

2. Make wall penetration sized to accommodate the pipe plus the hydrostatic Wall Seal.

3. Provide cast metal escutcheons to close the interior side of the structure penetration.

4. Wall Seal: Provide hydrostatic Wall Seal, as specified previously herein, for underground piping passing through core-drilled openings.

3.02 ANCHOR AND FASTENER INSTALLATIONS

A. Auxiliary Steel Fabrication: Insofar as possible, fit and shop assemble steel fabrications and make ready for field installation.
1. Drill or punch holes as required for attachment of work and for bolted connections. Burned holes are not acceptable.

2. Perform welding of assemblies in accordance with AWS D1.1. Dress welds smooth and free of sharp edges and corners.

3. Perform shop painting of auxiliary steel as specified in Section 15000.

B. Threaded Bolts: Draw threaded bolted connections up tight using lock washers to prevent bolt or nut loosening.

C. Anchors and Fasteners Installations in Wood Structural Members:

1. Lag Screw and Drive Screw Installations: For lag screws and drive screws in wood, predrill holes same diameter as root of threads, and enlarge holes to shank diameter for length of shank. Draw screws up tight using lock washers to prevent screw loosening.

D. Drilled-In Expansion Anchor and Fastener Installation:

1. General: In general, install expansion anchors in strict accordance with manufacturer's instructions and in accordance with the following.

2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.

3. Minimum Embedment: Embed expansion anchors to four and one-half bolt diameters, unless otherwise indicated on Drawings.

E. Drilled-In Adhesive Anchor Installation:

1. General: In general, install adhesive anchors in strict accordance with manufacturer's instructions and in accordance with the following.

2. Drilling Holes: Use rotary hammer type drill and make drill holes to the required diameter and depth as consistent with anchor manufacturer's instructions for size of anchors being installed.
a. Prior to setting cartridge and anchor stud clean drilled holes free of loose material by vacuum process, finishing with a blast of compressed air, and cover hole until actual use.

3. Anchor Rod Installation: Following cartridge installation in prepared drill holes, set anchor rod to the required depth. Set anchor rods truly perpendicular (normal) to the base plate of item being anchored.

4. Minimum Embedment Table:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>3/8 in.</th>
<th>½ in.</th>
<th>5/8 in.</th>
<th>3/4 in.</th>
<th>7/8 in.</th>
<th>1 in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Embedment</td>
<td>3½ in.</td>
<td>4¼ in.</td>
<td>5 in.</td>
<td>6-5/8 in.</td>
<td>6-5/8 in.</td>
<td>8¼ in.</td>
</tr>
<tr>
<td>Depth</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tbody>
</table>

END OF SECTION
SECTION 15080
MECHANICAL INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes the following:

1. Services and work of an administrative nature as well as general requirements concerning certain products and operations, all common to the entire Division 15 Sections.

B. Related Sections:

1. Division 15 Sections as Included.

2. Mechanical Requirements: Section 15010.

C. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for correct fabrication and installation of fibrous glass thermal insulation wrap on air duct systems of sheet metal, domestic water piping, in accordance with applicable project drawings and specifications.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM C 533; Specification for Calcium Silicate Block and Pipe Thermal Insulation.

2. ASTM C 534; Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.


4. ASTM C 553; Mineral Fiber Blanket and Felt Insulation (Industrial Type).

5. ASTM C 612; Specification for Mineral Fiber Block and Board Thermal Insulation.


B. National Fire Protection Association (NFPA):

1. NFPA 90A; Standard for the Installation of Air Conditioning and Ventilating Systems.

2. NFPA 90B; Standard for the Installation of Warm Air Heating and Air Conditioning Systems.

3. NFPA 255; Method of Test of Surface Burning Characteristics of Building Materials.

C. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): SMACNA Fibrous Glass Duct Construction Standards.

D. Underwriters' Laboratories, Inc. (UL):

1. UL 181 Class 1 Duct.

2. UL 723 Fire and Smoke Hazard Classification.

1.03 SUBMITTALS

A. Product Data: As specified in Section 15010; submittals required for the following items:

1. Pipe Insulating Materials.

2. Duct Insulating Materials.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver and store insulation products protected from the weather. Store insulation on the site elevated off wet and otherwise contaminating surfaces.
PART 2 PRODUCTS

2.01 PIPE INSULATING MATERIALS

A. Materials Option: Two types of pipe insulation materials are specified herein at the Contractor’s option for pipe insulating; except for those pipe services scheduled to be insulated with Flexible insulation only or Rigid insulation only. However, mixing of insulation materials will not be permitted; except where specified otherwise herein or where directed otherwise by the Project Manager.

B. Flexible Insulation (For Pipe Sizes 1/2 in. Thru 5 in.): Insulation manufactured of closed cell, 5 to 6 pounds per cubic foot density foamed plastic with thermal conductivity of 0.27 BTUH per sq. ft. per degree per inch at 75 degrees F. mean temperature, water vapor transmission rating of less than 0.2 perms. per inch, and a self-extinguishing fire-rating, (25 flame spread and 50 smoke developed), ASTM E 84. Insulation designed for use at temperatures between -20\(^\circ\) F and 220\(^\circ\) F. Insulation manufactured to meet requirements of ASTM C 534.

1. Provide insulation manufacturer’s companion joint making/sealing adhesive to make permanent insulation joints.

2. Fitting Insulation (Flexible): Insulate fittings and valve bodies with sleeves of same insulation thickness used on adjacent piping and having an inside diameter large enough to fit over the insulation on adjacent piping.

3. Acceptable Manufacturers:
   a. Manville Products Corp.; Aerotube AP.
   b. Owens-Corning Fiberglas.
   c. Armstrong Industry Products Division.
   d. Or Approved Equal.

C. Rigid Insulation on Piping: Rigid one-piece, hinged-construction, glass fiber insulation with composite (insulation, jacket or facing, and sealing adhesive) fire and smoke hazard ratings meeting requirements of NFPA 90A Standards, tested per ASTM E 84, NFPA 255 and UL 723, not to exceed a Flame Spread rating of 25.
and a Smoke Developed rating of 50. Products or their shipping cartons shall bear a label indicating above requirements. Insulation shall have a maximum thermal conductivity of 0.23 BTUH per sq. ft. per degree F. per inch at 75 degrees F. mean temperature. Water vapor transmission ASTM E 96 rating of 0.02 perms per inch maximum using a jacket of white kraft bonded to aluminum foil and reinforced with fiberglass yarn. Insulation designed for maximum service temperature of 850°F. Insulation manufactured to meet requirements of ASTM C 547.

1. Provide insulation manufacturer’s companion joint making/sealing adhesive to make permanent insulation joints.

2. Insulated Fitting Covers: Insulate fittings and valve bodies with a factory-premolded one-piece polyvinyl chloride (PVC) insulated cover. PVC cover self-extinguishing with a flame spread of 25 or less with a fuel contribution rating of 0, tested per ASTM E 84. Insulation inserts of glass fiber and noncombustible with a K factor of .28 at 75 degrees F. mean temperature.

3. Acceptable Manufacturers:
   b. Owens-Corning Fiberglas.
   c. Certain-Teed.
   d. Or Approved Equal.

D. Pipe Insulation Weatherizing Jacketing: Composed of high-impact polyvinyl (PVC) material in minimum 20 mil thickness for both straight section jacketing and formed fitting covers. The material shall conform to the following:

1. Basic Physical Properties:
   a. Maximum Surface Temperature Limit: 150 degrees F.
   b. Fire Rating: 25 flame spread and 50 smoke developed, maximums, per ASTM E 84.
   c. Electrical Conductance: Non-conductor.

2. Approvals: Jacketing and sealing system shall meet USDA and FDA requirements.

3. Fitting and Device Covers: Pre-molded shapes of types and designs suited to in-line insulated fitting types and devices.

4. Sealing System: Manufacturer's standard solvent-welding adhesive to form an absolute weathertight jacketing system. Provide manufacturer's PVC sealing tape for sealing jacketing and fitting cover terminations against bare metal on in-line devices.

5. Acceptable Manufacturers:
   b. Or Approved Equal.

2.02 DUCTWORK INSULATING MATERIALS

A. The duct wrap insulation shall consist of a blanket of glass fibers factory-laminated to a reinforced foil / kraft (FRK) vapor retarder facing with a 2" (min.) stapling and taping flange on one edge.

B. All supply ducts, return ducts and related fittings shall be insulated with the following:

   1. Owens Corning Fiberglass All-Service Duct Wrap, Type 75, 0.75 lb/cu.ft. density: 1 1/2" thickness with an installed R-Value of 4.2. Provide either the listed product or an approved equal.

C. All domestic hot and cold water piping shall be insulated with 1" fiberglass pipe insulation.

PART 3 EXECUTION

3.01 INSPECTION

A. Carefully inspect installed work of other Trades in connection with insulating work and verify such work to be complete, including system or equipment testing, to such point where insulating work may begin.
3.02 PREPARATION

A. Apply insulation on clean, dry surfaces only. Perform cleaning required for removal of construction debris, spills, etc.

3.03 INSTALLATION

A. Install insulation continuous through structure penetration of surfaces being insulated.

B. Apply insulation on cold surfaces, where vapor barrier is integral with insulation in a continuous unbroken vapor seal. Adequately seal hanger, support, and anchor penetrations of insulation.

C. Apply specified insulation adhesive, sealers and coatings at the manufacturer’s recommended minimum coverage per gallon.

3.04 DUCTWORK INSULATING

A. Duct wrap shall be installed in accordance with manufacturer’s instructions in such a manner that the insulation will provide the installed R-value as published for the product and printed on the facing, thus assuring specified in-place thermal performance.

B. Before applying duct wrap, air ducts shall be clean, dry and tightly sealed at all joints and seams.

C. All portions of duct to receive duct wrap shall be completely covered with duct wrap.

D. A 2" piece of insulation shall be removed from the facing at the end of the piece of duct wrap to form an overlapping stapling and taping flap.

E. Install duct wrap insulation with facing outside so that the tape flap overlaps the insulation and facing at the other end of the piece of duct wrap. Adjacent sections of duct wrap insulation shall be tightly butted with the 2" stapling and taping flap overlapping. If ducts are rectangular or square, install so insulation is not excessively compressed at corners. Seams shall be stapled approximately 6" on center with 1/2" (min.) steel outward clinching staples.

F. Seams and joints shall be sealed with pressure-sensitive tape matching the insulation facing (either plain foil or FRK backing stock) or glass fabric and mastic. Cloth duct tape of any color or finish using reclaimed rubber adhesives is not recommended for use on duct wrap insulation. Adjacent sections of duct wrap shall
be tightly butted with the 2” tape flap overlapping.

G. Where rectangular ducts are 24” in width or greater, duct wrap insulation shall be additionally secured to the bottom of the duct with mechanical fasteners such as pins and speed clip washers, spaced on 18” centers (maximum) to prevent sagging of insulation.

H. Where a vapor retarder is required, seal all tears, punctures and other penetrations of the duct wrap facing using one of the above methods to provide a vapor tight system.

I. Upon completion of installation of duct wrap and before operation is to commence, visually inspect the system and verify that it has been correctly installed.

J. Open all system dampers and turn on fans to blow all scraps and other loose pieces of material out of the duct system. Allow for a means of removal of such material.

K. Check the duct system to ensure that there are no air leaks through joints.

3.05 PIPE INSULATING

A. Apply insulation materials on piped services listed and in accordance with thicknesses listed in the following paragraphs. Insulate fittings and valve bodies and in-line control devices, except gage and thermometer faces, setting or measuring scales integral with in-line devices and control handles.

B. Flexible Insulation Installation: Install on piping according to manufacturer's instructions, using specified adhesive to seal both longitudinal and butt joints. Insulate in-line appurtenances to the same thickness as adjoining insulation.

C. Installed Thickness: Install in 1/2-inch thick insulation on the following piping:

1. All exposed drainage lines.
2. Horizontal Rainwater Conductors and Roof Drain Bodies.

3.06 PVC PIPE INSULATION JACKET

A. Apply PVC pipe insulation jacket to all exposed piping insulation within building.
3.07 SAFETY PRECAUTIONS

A. Contractor’s employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats and eye protection.

B. The contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

END OF SECTION
SECTION 15140
DOMESTIC WATER PIPING

PART 1 GENERAL

1.01 GENERAL

A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:

1. Service Entrance Piping: 100 psig (690 kPa).


B. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

C. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

D. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic potable-water piping components. Include marking "NSF-pw" on plastic potable-water piping.

E. Comply with NSF 61, "Drinking Water System Components--Health Effects," Sections 1 through 9 for potable-water piping and components.

F. Refer to Division 1 Sections for submittals and quality control.

G. Refer to Section 15080 for Insulation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

B. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

C. Copper, Solder-Joint Pressure Fittings: ASME B16.18 cast-copper alloy or ASME B16.22 wrought copper.

D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.

F. Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

G. Transition Couplings: Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

H. Exterior Hose Bibbs: Automatic draining, Non-freeze, Rough bronze body, with key operated, renewable composition disc, 3/4-inch threaded or solder-joint inlet. Provide ASME B1.20.7 ¾ inch hose connection on outlet and integral or field-installed, nonremovable, drainable, hose-connection vacuum breaker.

I. Interior Hose Bibbs: Rough bronze body, with key operated, renewable composition disc, 3/4-inch threaded or solder-joint inlet. Provide ASME B1.20.7 ¾ inch hose connection on outlet and integral or field-installed, nonremovable, drainable, hose-connection vacuum breaker.

J. Backflow Preventer: The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve. There shall be no threads or screws in the waterway exposed to line fluids. Service of all internal components shall be through a single access cover secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks and an air gap drain fitting. The assembly shall meet the requirements of: USC Manual 8th Edition†; ASSE Std. 1013; AWWA Std. C511; CSA B64.4. The assembly shall be equal to a Watts Regulator Co. Series 009.

K. Refer to Division 15 Section 15050 "Valves" for general-duty valves.

PART 3 EXECUTION

3.01 INSTALLATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

B. Transition and special fittings with pressure ratings at least equal to
piping pressure rating may be used in applications below, unless otherwise indicated.

C. Flanges may be used on aboveground piping, unless otherwise indicated.

D. Underground, Service Entrance Piping: Do not use flanges or valves underground. Use the following: Service Entrance Piping: 100 psig (690 kPa).

   1. 2-inch NPS (DN50) and Smaller: Soft copper tube, Type K; copper, solder-joint pressure fittings; and soldered joints.

E. Aboveground, Water Distribution Piping: Use the following:

   1. 1-1/2-Inch NPS (DN40) and Smaller: Hard copper tube, Type L copper, solder-joint fittings; and soldered joints.

F. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:


G. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

H. Extend service entrance piping to exterior water service piping in sizes and locations indicated for service entrances into building. Refer to Division 2 Section "Water Systems" for water service piping.

I. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside building at each service entrance pipe.

J. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

K. Install interior piping with 0.25 percent slope downward toward drain.

L. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.

M. Rough-in water piping and install water meters according to utility
company's requirements. Water meters will be furnished by utility.

N. Sectional Valves: Install sectional valves close to main on each branch and riser serving plumbing fixtures or equipment, and where indicated. Use gate or ball valves for piping 2-inch NPS (DN50) and smaller.

O. Shutoff Valves: Install shutoff valve on each water supply to equipment, on each supply to plumbing fixtures without supply stops, and where indicated. Use gate or ball valves for piping 2-inch NPS (DN50) and smaller.

P. Drain Valves: Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

1. Install hose-end drain valves at low points in water mains, risers, and branches.

2. Install stop-and-waste drain valves where indicated.

Q. Support vertical piping and tubing at base and at each floor.

R. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

S. Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. 3/4-Inch NPS (DN20) and Smaller: Maximum horizontal spacing, 60 inches (1500 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).

2. 1-Inch NPS (DN25): Maximum horizontal spacing, 72 inches (1800 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).

3. 1-1/4-Inch NPS (DN32): Maximum horizontal spacing, 72 inches (1800 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).

4. 1-1/2 and 2-Inch NPS (DN40 and DN50): Maximum horizontal spacing, 96 inches (2400 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).

T. Connect service entrance piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
U. Connect water distribution piping to service entrance piping at shutoff valve, and extend to and connect to plumbing fixtures and equipment.

V. Inspect water piping as follows:
1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
   a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

W. Test water piping as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
3. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.

X. Clean and disinfect water piping as follows:
1. Purge new piping and parts of existing water piping that have been altered, extended, or repaired before using.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, procedure described in either AWWA C651 or AWWA C652 or as described below:
   a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
   b. Fill and isolate system according to either of the following:
      1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      c. Flush system with clean, potable water until chlorine is no longer in water coming from system after the standing time.
      d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows contamination.

Y. Clean interior of piping system. Remove dirt and debris as work progresses.

Z. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.

AA. Perform the following steps before putting into operation:
   1. Close drain valves, hydrants, and hose bibbs.
   2. Open shutoff valves to fully open position.
   3. Open throttling valves to proper setting.
   4. Remove plugs used during testing of piping and plugs used for temporary sealing of piping during installation.
   5. Remove and clean strainer screens. Close drain valves and replace drain plugs.

BB. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
CC. Check plumbing specialties and verify proper settings, adjustments, and operation.

END OF SECTION
SECTION 15150
SANITARY: WASTE AND VENT PIPING

PART 1 GENERAL

1.01 GENERAL

A. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

B. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

PART 2 PRODUCTS

2.01 MATERIALS

A. Hub-and-Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service class. Include ASTM C 564 rubber gasket for each hub.

B. Hubless, Cast-Iron Soil Pipe: ASTM A 888 or CISPI 301.


D. Hub-and-Spigot, Cast-Iron, Soil-Pipe Fittings: ASTM A 74, Service class, hub and spigot. Include ASTM C 564 rubber gasket for each hub.

E. Hubless, Cast-Iron, Soil-Piping Couplings: CISPI 301.

F. Copper, Solder-Joint Drainage Fittings: ASME B16.23 cast copper or ASME B16.29 wrought copper.

G. Solder: ASTM B 32, Alloy Sn95, Sn94, or E; lead free.

H. Hubless, Cast-Iron, Soil-Piping Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve or gasket with integral, center pipe stop. Include the following:
1. **Heavy-Duty, Stainless-Steel Couplings:** ASTM A 666, Type 304, stainless-steel housing or shield; and stainless-steel clamps. Include gasket.
   
a. **Clamp Width:** 3 inches (75 mm) wide with 4 clamps, for piping 1-1/2- to 4-inch NPS (DN40 to DN100).

b. **Clamp Width:** 4 inches (100 mm) wide with 6 clamps, for piping 5- to 10-inch NPS (DN125 to DN250).

I. **Transition Couplings:** Coupling or other manufactured fitting same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

J. **Cleanouts:** ASME A112.36.2M, cast-iron body with straight threads and gasket seal or taper threads for plug, flashing flange and clamping ring, and a brass closure plug. Floor cleanout top-loading classification: Medium duty. Floor cleanout top finish: Round, Nickel Brass.

K. **Floor Drains:** ASME A112.21.1M, cast-iron body, with seepage flange and clamping device. Floor drains for installation in floors not having membrane waterproofing may have seepage flange without clamping device. Floor drains for use as area drains in exterior slab on grade may be furnished with anchor flange instead of seepage flange and clamping device. Floor drain shall be equipped with strainer, trap primer and sediment bucket. Cover and body top finish: Nickel Brass, Round. Top-loading classification: Medium Duty

L. **Trap Seal Primer Valves:** ASSE 1018, water-supply-fed type, with the following characteristics:
   
   1. 125 psig (860 kPa) minimum working pressure.
   
   2. Bronze body with atmospheric-vented drain chamber.
   
   3. **Inlet and Outlet Connections:** 1/2 inch (DN 15) threaded, union, or solder joint.
   
   4. **Gravity Drain Outlet Connection:** 1/2 inch (DN 15) threaded or solder joint.
   
   5. Finish: Chrome plated, or rough bronze for units used with pipe.
PART 3 EXECUTION

3.01 INSTALLATION

A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

B. Aboveground, Soil, Waste, and Vent Piping: Use the following:

1. 1-1/2-Inch NPS (DN40): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and one of the following hubless, cast-iron, soil-piping couplings:

2. 1-1/2-Inch NPS (DN40): Hard copper drainage tube; copper, solder-joint drainage fittings; and soldered joints.

3. 2- to 4-Inch NPS (DN50 to DN100): Hub-and-spigot, cast-iron soil pipe, Service class; hub-and-spigot, cast-iron, soil-pipe fittings, Service class; and compression joints.

4. 2- to 4-Inch NPS (DN50 to DN100): Hubless, cast-iron soil pipe; hubless, cast-iron, soil-pipe fittings; and one of the following hubless, cast-iron, soil-piping couplings:

5. 5- to 8-Inch NPS (DN125 to DN200): Hub-and-spigot, cast-iron soil pipe, service class; hub-and-spigot, cast-iron, soil-pipe fittings, service class; and compression joints.

C. Underground, Soil, Waste, and Vent Piping: Use the following:

1. 2- to 4-Inch NPS (DN50 to DN100): Hub-and-spigot, cast-iron soil pipe, extra heavy class; hub-and-spigot, cast-iron, soil-pipe fittings, extra heavy class; and compression joints.

2. 5- to 12-Inch NPS (DN125 to DN300): Hub-and-spigot, cast-iron soil pipe, extra heavy class; hub-and-spigot, cast-iron, soil-pipe fittings, extra heavy class; and compression joints.

D. Aboveground, Storm Drainage Piping: Use the following:

1. 2- to 4-Inch NPS (DN50 to DN100): Hub-and-spigot, cast-iron soil pipe, extra heavy class; hub-and-spigot, cast-iron, soil-pipe fittings, extra heavy class; and compression joints.
iron soil pipe, Service class; hub-and-spigot, cast-iron, soil-pipe fittings, Service class; and compression joints.

2. 5- to 8-Inch NPS (DN125 to DN200): Hub-and-spigot, cast-iron soil pipe, Service class; hub-and-spigot, cast-iron, soil-pipe fittings, Service class; and compression joints.

E. Underground, Storm Drainage Piping: Use the following:

1. 3- and 10-Inch NPS (DN80 and DN2500): Hub-and-spigot, cast-iron soil pipe, extra heavy class; hub-and-spigot, cast-iron, soil-pipe fittings, extra heavy class; and compression joints.

F. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.

G. Extend building sanitary drain piping and connect to sanitary sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building sanitary drains with building sanitary sewers.

H. Extend building storm drain piping and connect to storm sewer piping in sizes and locations indicated for service entrances into building. Install cleanout and extension to grade at connections of building storm drains and building storm sewers.

I. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service entrance pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.

J. Install traps at all fixtures without integral traps. Install trap primer on all floor drains.


L. Make changes in direction for drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are
installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not make change in direction of flow greater than 90 degrees. Use proper size of standard increasers and reducers if different sizes of piping are connected. Reducing size of drainage piping in direction of flow is prohibited.

M. Lay buried building drain piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

N. Install drainage and vent piping at the following minimum slopes, unless otherwise indicated:

   1. Sanitary Building Drain:  2 percent downward in direction of flow for piping 3-inch NPS (DN80) and smaller; 1 percent downward in direction of flow for piping 4-inch NPS (DN100) and larger.

   2. Horizontal, Sanitary Drainage Piping:  2 percent downward in direction of flow.

   3. Storm Building Drain:  1 percent downward in direction of flow.

   4. Horizontal, Storm Drainage Piping:  2 percent downward in direction of flow.

   5. Vent Piping:  1 percent down toward vertical fixture vent or toward vent stack.

O. Sleeves are not required for cast-iron soil piping passing through concrete slab on grade if slab is without membrane waterproofing.

P. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.


   1. Compression Joints: Make with rubber gasket matching class of pipe and fittings.
2. **Hubless Joints**: Make with rubber gasket and sleeve or clamp.

**R.** Support vertical piping and tubing at base and at each floor.

**S.** Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

**T.** Install hangers for copper tubing with the following maximum spacing and minimum rod diameters:

1. 1-1/4-Inch NPS (DN32): Maximum horizontal spacing, 72 inches (1800 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).

2. 1-1/2 and 2-Inch NPS (DN40 and DN50): Maximum horizontal spacing, 96 inches (2400 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).

3. 3- to 5-Inch NPS (DN80 to DN125): Maximum horizontal spacing, 10 feet (3 m) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 10 feet (3 m).

**U.** Install hangers for cast-iron soil piping with the following maximum spacing and minimum rod diameters:

1. 1-1/2- and 2-Inch NPS (DN40 and DN50): Maximum horizontal spacing, 60 inches (1500 mm) with 3/8-inch (10-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).

2. 3-Inch NPS (DN80): Maximum horizontal spacing, 60 inches (1500 mm) with 1/2-inch (13-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).

3. 4- and 5-Inch NPS (DN100 and DN125): Maximum horizontal spacing, 60 inches (1500 mm) with 5/8-inch (16-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).

4. 6-Inch NPS (DN150): Maximum horizontal spacing, 60 inches (1500 mm) with 3/4-inch (19-mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).

5. 8- and 10-Inch NPS (DN200 and DN250): Maximum horizontal spacing, 60 inches (1500 mm) with 7/8-inch (22-
mm) minimum rod diameter; maximum vertical spacing, 15 feet (4.5 m).

6. Spacing for horizontal pipe in 10-foot (3-m) lengths may be increased to 10 feet (3 m). Spacing for fittings is limited to 60 inches (1500 mm).

V. Connect service entrance piping to exterior sewerage and drainage piping. Use transition fitting to join dissimilar piping materials.

W. Connect drainage piping to service entrance piping, and extend to and connect to plumbing fixtures, specialties, and equipment.

X. Inspect drainage and vent piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

   a. Roughing-In Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

   b. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

Y. Test drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedure, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.

3. Roughing-In Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10 feet of head (30 kPa). Water level must not drop from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects using new materials and retest piping or portion thereof until satisfactory results are obtained.

Z. Clean interior of piping system. Remove dirt and debris as work progresses.

AA. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

BB. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION
SECTION 15194

FUEL GAS PIPING

PART 1  GENERAL

1.01  RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02  SUMMARY

A. This Section includes fuel gas piping within the building. Products include the following:

1. Pipe, tube, fittings, and joining materials.
2. Protective pipe and fitting coating.
3. Piping specialties.
4. Pressure regulators.

1.03  PROJECT CONDITIONS

A. Gas System Pressure: One pressure range. 0.5 psig or less.
B. Design values of fuel gas supplied for these systems are as follows:

2. Nominal Specific Gravity: 0.6.

1.04  SUBMITTALS

A. Product Data: For the following:

1. Specialty valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
2. Pressure regulators. Include pressure rating, capacity, and settings of selected models.
4. Operation and Maintenance Data: For natural gas specialties and accessories to include in emergency, operations, and maintenance manuals

1.05 QUALITY ASSURANCE

A. Electrical Components and Devices: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.


1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and legally dispose of liquids from drips in existing gas piping. Handle cautiously to avoid spillage and ignition. Notify fuel gas supplier. Handle flammable liquids used by Installer with proper precautions and do not leave on premises from end of one day to beginning of next day.

1.07 COORDINATION

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Architect's written permission.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.03 PIPES, TUBES, FITTINGS, AND JOINING MATERIALS

A. Steel Pipe: ASTM A 53/A 53M; Type E or S; Grade B; black. Wall thickness of wrought-steel pipe shall comply with ASME B36.10M.


2. Steel Threaded Fittings: ASME B16.11, forged steel with threaded ends according to ASME B1.20.1.


7. Steel Flanges and Flanged Fittings: ASME B16.5.

8. Gasket Material: Thickness, material, and type suitable for natural gas.

2.04 PROTECTIVE COATING

A. Furnish pipe and fittings with factory-applied, corrosion-resistant polyethylene coating for use in contact with materials that may corrode the pipe.

2.05 PIPING SPECIALTIES


2.06 SPECIALTY VALVES

A. Valves, NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.


1. Available Manufacturers:
   a. American Valve Inc.
   b. B&K Industries, Inc.
   c. Brass Craft Manufacturing Co.
   d. Cimberio Valves, S. p. A.
   e. Conbraco Industries, Inc.; Apollo Div.
   g. JMF Company.
   h. Jomar International Ltd.
   i. Key Gas Components, Inc.
   j. Legend Valve and Fitting, Inc.
   k. McDonald, A. Y. Mfg. Co.
   n. Robert Manufacturing Co.
   o. State Metals, Inc.

C. Gas Stops: Bronze body with AGA stamp, plug type with bronze plug and flat or square head, ball type with chrome-plated brass ball and lever handle, or butterfly valve with stainless-steel disc and fluorocarbon elastomer seal and lever handle; 2-psig minimum pressure rating.

D. Gas Valves, NPS 2 and Smaller: ASME B16.33 and CSA
International-listed bronze body and 125-psig pressure rating.

1. Available Manufacturers:
   a. BMI Canada, Inc.
   b. Crane Valves.
   c. Dungs, Karl, Inc.
   d. Flow Control Equipment, Inc.
   e. Grinnell Corp.
   f. Honeywell International Inc.
   g. Jomar International Ltd.
   h. KITZ Corporation.
   i. Legend Valve and Fitting, Inc.
   j. Lyall, R. W. & Co., Inc.
   k. McDonald, A. Y. Mfg. Co.
   l. Milwaukee Valve Company.
   m. Mueller Co.; Mueller Gas Products Div.
   n. NIBCO INC.
   o. Red-White Valve Corp.
   p. Velan Inc.
   q. Watts Industries, Inc.; Water Products Div.

2. Tamperproof Feature: Include design for locking.


1. Available Manufacturers:
   a. ASCO General Controls.
   b. ASCO Power Technologies, LP; Division of Emerson.
   c. ASCO Valve Canada, Division of Emerson Electric
Canada Limited.

d. Dungs, Karl, Inc.

e. Eaton Corporation; Controls Div.

f. Eclipse Combustion, Inc.

g. GPS Gas Protection Systems Inc.

h. Honeywell International Inc.

i. Johnson Controls.

F. Electrically Operated Gas Valves: UL 429, bronze, aluminum, or cast-iron body solenoid valve; 120-V ac, 60 Hz, Class B, continuous-duty molded coil. Include NEMA ISC 6, Type 4, coil enclosure and electrically opened and closed dual coils. Valve position shall normally be closed.

1. Available Manufacturers:

a. ASCO General Controls.

b. ASCO Power Technologies, LP; Division of Emerson.

c. Dungs, Karl, Inc.

d. Eclipse Combustion, Inc.

e. Goyen Valve Corp.; Tyco Environmental Systems.

f. Magnatrol Valve Corp.

g. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.

h. Watts Industries, Inc.

2.07 PRESSURE REGULATORS

A. Description: Single stage and suitable for fuel gas service. Include steel jacket and corrosion-resistant components, elevation compensator, and atmospheric vent.

1. Available Manufacturers:

a. Service Pressure Regulators:
1) American Meter Company.

2) Fisher Controls International, Inc.; Division of Emerson.

3) Invensys.

4) National Meter Industries, Inc.

5) Richards Industries, Inc.; Jordan Valve Div.

6) Schlumberger Limited; Gas Div.

b. Line Pressure Regulators:

1) American Meter Company.

2) Donkin, Bryan RMG Canada, Ltd.

3) Eclipse Combustion, Inc.

4) Fisher Controls International, Inc.; Division of Emerson.

5) Invensys.

6) Maxitrol Company.

7) National Meter Industries, Inc.

8) Richards Industries, Inc.; Jordan Valve Div.

9) Schlumberger Limited; Gas Div.

c. Appliance Pressure Regulators:

1) Canadian Meter Co., Inc.

2) Eaton Corporation; Controls Div.

3) Harper Wyman Co.

4) Maxitrol Company.

5) SCP, Inc.

2. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1 for pipe threads.
PART 3 EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for fuel gas piping system to verify actual locations of piping connections before equipment installation.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Close equipment shutoff valves before turning off fuel gas to premises or section of piping. Perform leakage test as specified in "Field Quality Control" Article to determine that all equipment is turned off in affected piping section.

3.03 SERVICE ENTRANCE PIPING

A. Extend fuel gas piping and connect to fuel gas distribution for service entrance to building.

1. Exterior fuel gas distribution system piping, service pressure regulator, and service meter will be provided by gas utility.

B. Install dielectric fitting downstream from and adjacent to each service meter unless meter is supported from service-meter bar with integral dielectric fitting. Install shutoff valve downstream from and adjacent to dielectric fitting. Dielectric fittings are specified in Division 15 Section "Basic Mechanical Materials and Methods."

3.04 PIPING APPLICATIONS

A. Flanges, unions, transition, and special fittings with pressure ratings same as or higher than system pressure rating may be used in applications below, unless otherwise indicated.

B. Fuel Gas Piping, 2 psig or Less:

1. NPS 2 and Smaller: NPS 3 steel pipe, malleable-iron threaded fittings, and threaded joints.

3.05 VALVE APPLICATIONS

A. Appliance Shutoff Valves for Pressure 0.5 psig or Less: Appliance...
connector valve or gas stop.

B. Piping Line Valves, NPS 2 and Smaller: Gas valve.

3.06 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Drips and Sediment Traps: Install drips at points where condensate may collect. Include outlets of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use minimum-length nipple of 3 pipe diameters, but not less than 3 inches long, and same size as connected pipe. Install with space between bottom of drip and floor for removal of plug or cap.

C. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels, unless indicated to be exposed to view.

D. Install fuel gas piping at uniform grade of 0.1 percent slope upward toward risers.

E. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

F. Connect branch piping from top or side of horizontal piping.

G. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

H. Install strainer on inlet of each line pressure regulator and automatic and electrically operated valve.

I. Install pressure gage downstream from each line pressure regulator. Pressure gages are specified in Division 15 Section "Meters and Gages."

J. Install vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.
3.07 JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Use materials suitable for fuel gas.

C. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

3.08 HANGER AND SUPPORT INSTALLATION

A. Pipe hanger and support and equipment support materials and installation requirements are specified in Division 15 Section "Hangers and Supports."

B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.

2. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

3.09 CONNECTIONS

A. Drawings indicate general arrangement of fuel gas piping, fittings, and specialties.

B. Install piping adjacent to appliances to allow service and maintenance.

C. Connect piping to appliances using gas with shutoff valves and unions. Install valve upstream from and within 72 inches of each appliance. Install union downstream from valve.

D. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance using gas.

E. Ground equipment according to Division 16 Section "Grounding and Bonding."

1. Do not use gas pipe as grounding electrode.

F. Connect wiring according to Division 16 Section "Conductors and Cables."
3.10 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each service meter, pressure regulator, and specialty valve.

1. Text: In addition to name of identified unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

2. Nameplates, pipe identification, and signs are specified in Division 15 Section "Mechanical Identification."

3.11 PAINTING

A. Use materials and procedures in Division 9 painting Sections.

3.12 FIELD QUALITY CONTROL

A. Test, inspect, and purge piping according to NFPA 54 and requirements of authorities having jurisdiction.

B. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

C. Verify capacities and pressure ratings of service meters, pressure regulators, valves, and specialties.

D. Verify correct pressure settings for pressure regulators.

E. Verify that specified piping tests are complete.

END OF SECTION
SECTION 15410

PLUMBING FIXTURES

PART 1   GENERAL

1.01   DESCRIPTION

A. Provide all labor, materials, tools, equipment and services required to furnish, deliver and install all work under this section as required by the Contract Drawings and as specified herein.

B. Following is a brief description of the work included, but shall not be considered as complete and all inclusive:

1. Plumbing Fixtures
2. Trim
3. Accessories
4. Valves

1.02   RELATED DOCUMENTS

A. Section 15060— Hangers and Supports
B. Section 15100— Building Services Piping

1.03   SUBMITTALS

A. Submission Required: Included shop drawings, manufacturer’s descriptive literature and published details with performance / capacity rating schedules or charts as applicable.

B. Shop drawings shall show locations of Plumbing Fixtures which are to comply with Americans with Disabilities Act.

PART 2   PRODUCTS

2.01   GENERAL

A. Manufacturer’s products as listed herein are to establish the quality of the products desired:

1. Sloan
2. Kohler
3. Speakman
4. Or approved equal

2.02 WATER CLOSET HANDICAPPED (ADA COMPLIANT)

A. Fixture
   1. Floor Mounted
      a. American Standard “Cadet 3” 17 H EL L6/FV, Model No. 2835.128 top spud, vitreous china, floor mounted, siphon jet action, elongated bowl, flushes on 1.28 gallons, Cadet 3 flushing system, color - white.

   B. Seat: Church - No. 9500C, open front seat less cover, solid high impact polystyrene plastic, elongated, stainless steel hinge post with combination self sustaining and concealed check.

2.03 SERVICE SINK

A. Fixture
   1. Mop Receptor
      a. American Standard “Florwell Service Sink”, Model No. 7745.8 11, corner model, enameled cast iron, removable vinyl coated rim guard, approximate size 28”x 28” x 13” high, color- white.

   B. Faucet: American Standard, Model No. 8344.112, wall mounted, supplied with a rough chrome finish, top brace, vacuum breaker, lever handles, bucket hook, 6” spout, 1/2” NPT (Female) inlets.

   C. Accessories: Provide mop and hose hanger equal to El Mustee and son.

2.04 LAVATORY HANDICAPPED (ADA COMPLIANT)

A. Fixture: American Standard “Lucerne Wall Hung Lavatory” Model No.0356.015, faucet holes on 8” centers, vitreous china, front overflow, D shaped bowl, self draining deck area with contoured back and side splash shields, approximate size 20 Y2”x 18 ¼”x 7” high, color - white.

   B. Faucet: Sloan Optima sensor faucet model no. ETF-80 cast brass valve body with reinforced flexible hose connections for 6” to 12”
installation with mixing valve, 0.5 GPM aerator, automatic sensor, chrome finish.

C. Drain: Grid drain strainer. Pop-up drain not acceptable.

D. Provide chrome plated brass fittings including P-Trap with clean out and shut-off valves.

E. Provide ADA compliant under sink pipe cover.

2.05 URINAL (ADA COMPLIANT)

A. Fixture: American Standard “Washbrook” High efficiency Urinal, Wall Hung” Model No.6590.005, Vitreous china, high Efficiency (0.5 gpf/1.9 Lpf) Flushing rim, elongated 14" rim from finished wall, Washout flush action, extended sides for privacy, 3/4" inlet spud, outlet connection threaded 2" inside (NPTF), 2 wall hangers, Meets ANSI flush requirements, Color - white.

B. Flush Valve: Electronic proximity infrared sensor activated urinal flush valve shall feature self-cleaning piston valve. Includes a fully mechanical manual over-ride that can provide a complete flush without battery power. Includes cast brass valve body and metal cover with chrome finish, vandal resistant stop cap and lithium battery. Angle stop with back-flow protection and vacuum breaker included. 0.5 gpf / 1.9 Lpf Flush. Valve shall be equal to American Model # 6063.051.002. For 3/4" top spud urinals. Inlet includes 3/4" I.P.S. angle stop with back-flow protection

2.06 ELECTRIC WATER COOLER HANDICAPPED (ADA COMPLIANT)

A. Fixture: Elkay, Model No. LVRCTL8SC, Bi-level, ADA compliant, Self contained, wall hung, electric refrigerated water cooler. Capacity: 7.6 GPH at 50 degree F drinking water. Vandal resistant push button, vandal resistant stainless steel bubbler. Constructed of 16 gauge. Galvanized steel chassis with stainless steel top polished to uniform satin finish. 115 volt, single phase, 60 hertz, 3.5 full load amps.

B. Provide chrome plated brass fittings including P-Trap with clean out and shut-off valves.

PART 3 EXECUTION

3.01 INSTALLATION

A. All work shall be in accordance with the City or Township Plumbing Code of jurisdiction, also to comply with the Americans with
Disabilities Act.

B. Carrier for Lavatory shall be floor mounted single carrier with concealed aims, leveling and securing screws, structural uprights, with welded feet and bolted to floor.

C. Exposed pipes under Lavatory must be insulated or otherwise configured to protect against contact. Exposed sharp or abrasive edges are prohibited. Install foam or fiber insulation with protective over wrap on drain, water supply and sharp edges or use commercially available rigid pipe covers, per the Americans with Disabilities Act.

D. As soon as installed, all metal fixtures and trimmings shall be thoroughly covered with non-corrosive grease, maintained until all construction work is completed.

E. The Contractor shall be responsible for protecting against injury from building materials, acids, tools, and equipment; all plumbing fixtures include in this specification.

F. A bead of clear silicone shall be provided where each fixture contact wall or floor.

G. Adjust hot water mixing valve(s).

H. Adjust flush valve sensor(s).

I. Upon completion of installation, fixtures shall be cleaned, left in first class condition and in working order.

END OF SECTION
SECTION 15440

SUMP PUMP STATION AND CONTROLS

PART 1 GENERAL

1.01 DESCRIPTION

A. It is the intent and purpose of this specification to cover and include under each item the supplying of all materials, equipment, apparatus, and all other accessories as described herein to furnish:

1. (2) Manual Submersible Sump Pumps
2. (1) Duplex Nema 4X Control Panel
3. (4) Mercury free float switches

B. Any equipment, apparatus, material, or small items not mentioned in detail and not hereinafter specifically mentioned which may be found necessary to complete or perfect any portion of detailed equipment shall be furnished without extra cost to SEPTA excluding discharge piping and miscellaneous valving.

1.02 SUBMITTALS

A. The supplier shall submit six (6) copies of the following items.

1. Shop drawings, catalog cuts, illustrations, specification schedule and material lists showing complete details of all proposed equipment for approval prior to manufacture or ordering of said item.

1.03 CODES, REGULATIONS AND REFERENCE STANDARDS

A. All work described under this specification shall be done in accordance with the latest applicable Federal, State, and Local Codes, Laws, Ordinances, Rules, Regulations and Reference Standards.

1.04 DELIVERY OF EQUIPMENT

A. The supplier shall notify SEPTA at least three days prior to the delivery date of the equipment. The pumping station, controls and accessories shall be delivered to SEPTA at the time and location as specified in the bid documents.
1.05  OPERATION AND MAINTENANCE MANUALS

A. The supplier shall furnish SEPTA with three (3) complete copies of the following manuals in hard cover three ring binders:

1. Installation Instructions
2. Operating Instructions
3. Maintenance and Service
   a. Maintenance Schedule
   b. Trouble-Shooting Guide
   c. Disassembly, Repair and Reassemble.
   d. Alignment, Adjusting and Checking
4. Parts List

1.06  TESTING AND FINAL INSPECTION

A. The supplier shall provide the services of a factory-trained representative for start-up, field test, and calibration of pump control.

1.07  ACCEPTANCE AND WARRANTY

A. The manufacturer shall warrant in writing that its entire package shall be free of defects in design, materials and workmanship, for a period of twelve (12) months from the date of final equipment acceptance, under normal use and service.

B. Should some components be supplied or assembled by the vendor/distributor, the vendor/distributor shall warrant in writing that all supplied or assembled components shall be free of defects in design and system integration, materials and workmanship for a period of twelve (12) months unless a longer period standard warranty is offered by the equipment manufacturer.

C. Final equipment acceptance shall occur following the installation and successful operation of the equipment, but shall not exceed a period of 18 months from the date of receipt.

1.08  INITIAL AND FINAL OPERATING INSTRUCTIONS

A. The supplier shall provide SEPTA operation and maintenance personnel with six (6) hours of training (excluding travel time) on the operation and maintenance of the equipment supplied.
1.09 QUALIFICATION OF PUMPING STATION

A. The pumping station and controls supplier shall be a local (50 mile radius) authorized distributor/selling agent with minimum 5 years experience in furnishing and servicing pumps and controls. Service is to be local and provided only by the authorized factory representative.

B. Documentation must be provided with the bid package from the manufacturer on their letterhead that the pumping station supplier is authorized to sell and service the submersible pump(s) furnished and that the pump(s) offered are current production models. Failing to do so will result in disqualification.

C. The pump and controls manufacturer must be a leader in the field of pumping technology.

PART 2 PRODUCTS

2.01 DUPLEX SUBMERSIBLE SUMP PUMPS

A. General:

1. The submersible sump pump shall be Sewage type. Acceptable Manufacturers:

   a. F.E. Myers Company Supplied by Mid Atlantic Pump - Phone No. 856-768-3880

   b. Flygt

   c. Zoeller Pumps

   d. Or Approved Equal

B. Pump Characteristics

1. The sump pumps shall conform to the capacities, pumping heads, minimum heads, and minimum efficiencies as stated below.

2. The pumps shall be designed to handle raw unscreened water by hydraulic sealing. The pumps shall be capable of continuous submergence underwater without loss of watertight integrity.

3. Each pump shall have all of the following characteristics: Discharge Size —As shown on drawings
Nameplate Horsepower — As shown on drawings.
Speed (nominal) - As shown on drawings.
Electrical — As shown on drawings.
Capacity— As shown on drawings

C. Construction

1. General
   a. Pump shall be vertically mounted, volute-type, single suc-
   tion, submersible type designed to operate in a complete-
   ly or partially submerged situation and be capable of liq-
   uid handling of drain water to a solids handling of 2 inch
   solids. Pump shall be non-overloading through the entire
   range of operation without employing a safety factor.
   b. Motor housing, volute case shall be high quality gray cast
      iron, ASTM A-48, Class 30. The pump discharge shall be
      fitted with a standard 2” (Female) NPT connection. All ex-
      ternal-mating parts shall be machined and Buna N Rub-
      ber 0-ring sealed on a beveled edge. Gaskets shall not
      be acceptable. All fasteners exposed to the pumped liq-
      uids shall be 300 series stainless steel

2. Electrical Power Cord
   a. Electrical power cord shall be #16-3 type SJTW/STW-A
      type. Provide power cord with length necessary to ex-
      tend from floats to the control panel. Cord lengths shall
      be such that no splices will be required between the
      pump and control panel.
   b. The cord shall have a molded compression grommet to
      insulate electrical connections. The grommet shall thread
      into the motor housing to provide a positive seal and to
      prevent leaking of liquid into the motor housing. The seal-
      ing grommet shall provide strain relief for the power cord
      assembly.

3. Motor
   a. The pump motor(s) shall be of the submersible type rated
      as shown in the drawings.. Single phase motor shall be
      of the shaded pole type with no relays or starting switch-
      es. Stator winding shall be of the open type with Class A
      insulation rated for 221°F (105°C) maximum operating
      temperature. The winding housing shall be filled with
      clean dielectric oil to lubricate bearings and seals, and
transfer heat from the windings to be the outer shell. The motor winding assembly shall be pressed into the stator housing for best alignment and heat transfer.

b. The motor shall be capable of operating over the full range of the performance curve without overloading the motor and causing any objectionable noise or vibration. The motor shall have two bearings to support the rotor, an upper sleeve bearing to accommodate radial loads and a lower sleeve bearing with thrust pad to take thrust and radial loads.

c. A heat sensor thermostat and overload shall be attached to the top end of the motor windings and shall be wired in series with the windings to stop the motor if the motor winding temperature reaches 221°F. The overload thermostat shall reset automatically when the motor cools to a safe operating temperature.

d. Motors not manufactured in the Continental United States will not be considered. Verifications of US manufacture including foundry certification shall be supplied to the SEPTA PM at his or her request.

4. Bearings

a. Dual thrust washers with an upper and lower sleeve bearing shall be required, which are permanently lubricated by the dielectric oil, which fills the motor housing. Bearings which require lubrication according to a prescribed schedule shall not be acceptable.

5. Seals

a. The pump shall have a mechanical seal. Seal shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. Metal parts and springs for seal shall be 300 series stainless steel. The seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminants out of the seal area.

6. Casing

a. The casing shall be a high efficiency volute design capable of passing 2 inch spherical solids, having sufficient strength and thickness to withstand all stress and strain
from service at full operating pressure and load.

7. Pump Impeller
   a. The pump impeller shall be of the recessed type. The impeller shall be constructed of engineered Thermoplastic.

8. Data Plates and Hardware
   a. Data Plates: All data plates shall be of stainless steel or brass, suitably attached to the pump. Data plates shall contain the manufacturer’s name, pump size and type, serial number, speed, impeller diameter, capacity and head rating and other pertinent data.

9. Balance and Vibration
   a. Balance and vibration shall meet NEMA Standards MGI-12.05 and MG1-12.06.

D. LEVEL CONTROLS

1. Four non-mercury float type switches shall control the duplex pump control system. The float switches shall be sealed in a corrosion resistant polypropylene housing. Float switches shall be NEMA 6 rated. The wire shall be a minimum of 18-2 SJOW jacket cable.

2. The cable shall be of length necessary to extend from float switches to control panel with no splices.

3. Level control shall be UL / CSA Listed

E. SUMP- PUMP CONTROL PANEL

1. General
   a. Contractor shall furnish all labor, materials, equipment and incidentals required to provide a duplex motor control panel for the pumps. The control system shall start, stop, and alternate the pumps. The control system shall also provide indications of each pump’s operation.

   b. The motor control panel shall be assembled and tested by a shop meeting UL Standard 508 for industrial controls. The motor control panel shall be assembled and tested by the same manufacturer supplying the pumps so
as to insure suitability and assurance of experience in matching controls to motors and to insure single source responsibility for the equipment.

2. Construction

a. The controls for the pump shall be contained in a NEMA 4X, constructed of fiberglass reinforced polyester with a matched raised cover (door). Require hinged door and neoprene gasket.

b. The enclosure shall have stainless steel padlock hasp. A nameplate shall be permanently affixed to the panel and include the model number, voltage, phase, hertz, ampere rating and horsepower rating. A warning label against electric shock shall be permanently affixed to the outer door. All fasteners shall be 300 series stainless steel. The outer cover (door) shall be attached to the enclosure using stainless steel hinges.

c. A painted steel back panel shall be provided, or approved equal. The back panel shall be mounted on stainless steel bolts using stainless steel nuts and lock washers to maintain enclosure integrity and shall be used as the means for mounting the components in the enclosure.

d. For each pump an amber run pilot light, a green pump running light and a hand-off-auto switch shall be provided. Lights and hand-off-auto switches shall be mounted on front cover (door). The lights and hand-off-auto switches shall be properly labeled identifying the function for the switch or lights.

e. The System shall have a high level alarm. Provide a NEMA 4 audible alarm with test button and silence button in addition to the visual. Coordinate with Septa as to the appropriate location.

2.02 SIMPLEX SUBMERSIBLE SUMP PUMPS

A. General: Centrifugal, end-suction, single-stage sump pump, with motor and operating controls.

1. Acceptable Manufacturers:

a. F.E. Myers Company Supplied by Mid Atlantic Pump - Phone No. 856-768-3880
b. Flygt
c. Zoeller Pumps
d. Or Approved Equal

B. Pump Characteristics

1. The sump pumps shall conform to the capacities, pumping heads, minimum heads, and minimum efficiencies as stated below.

2. The pumps shall be designed to handle raw unscreened water by hydraulic sealing. The pumps shall be capable of continuous submergence underwater without loss of watertight integrity.

3. Each pump shall have all of the following characteristics:
   Discharge Size — As shown on drawings
   Nameplate Horsepower — As shown on drawings.
   Speed (nominal) - As shown on drawings.
   Electrical — As shown on drawings.
   Capacity— As shown on drawings

C. Construction

1. General
   a. Pump shall be vertically mounted, volute-type, single suction, submersible type designed to operate in a completely or partially submerged situation and be capable of liquid handling of drain water to a solids handling of 1/2 inch solids. Pump shall be non-overloading through the entire range of operation without employing a safety factor.

   b. Motor housing, volute case shall be high quality gray cast iron, ASTM A-48, Class 30. The pump discharge shall be fitted with a standard 2” (Female) NPT connection. All external-mating parts shall be machined and Buna N Rubber 0-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel

2. Electrical Power Cord
   a. Electrical power cord shall be #16-3 type SJTW/STW-A type. Provide power cord with length necessary to extend from floats to the control panel. Cord lengths shall
be such that no splices will be required between the pump and control panel.

b. The cord shall have a molded compression grommet to insulate electrical connections. The grommet shall thread into the motor housing to provide a positive seal and to prevent leaking of liquid into the motor housing. The sealing grommet shall provide strain relief for the power cord assembly.

3. Motor

a. The pump motor(s) shall be of the submersible type rated as shown in the drawings. Single phase motor shall be of the shaded pole type with no relays or starting switches. Stator winding shall be of the open type with Class A insulation rated for 221°F (105°C) maximum operating temperature. The winding housing shall be filled with clean dielectric oil to lubricate bearings and seals, and transfer heat from the windings to be the outer shell. The motor winding assembly shall be pressed into the stator housing for best alignment and heat transfer.

b. The motor shall be capable of operating over the full range of the performance curve without overloading the motor and causing any objectionable noise or vibration. The motor shall have two bearings to support the rotor, an upper sleeve bearing to accommodate radial loads and a lower sleeve bearing with thrust pad to take thrust and radial loads.

c. A heat sensor thermostat and overload shall be attached to the top end of the motor windings and shall be wired in series with the windings to stop the motor if the motor winding temperature reaches 221°F. The overload thermostat shall reset automatically when the motor cools to a safe operating temperature.

d. Motors not manufactured in the Continental United States will not be considered. Verifications of US manufacture including foundry certification shall be supplied to the SEPTA PM at his or her request.

4. Bearings

a. Dual thrust washers with an upper and lower sleeve bearing shall be required, which are permanently lubricated by the dielectric oil, which fills the motor housing.
Bearings which require lubrication according to a prescribed schedule shall not be acceptable.

5. Seals
   a. The pump shall have a mechanical seal. Seal shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. Metal parts and springs for seal shall be 300 series stainless steel. The seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminants out of the seal area.

6. Casing
   a. The casing shall be a high efficiency volute design capable of passing 2 inch spherical solids, having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load.

7. Pump Impeller
   a. The pump impeller shall be of the recessed type. The impeller shall be constructed of engineered Thermoplastic.

8. Data Plates and Hardware
   a. Data Plates: All data plates shall be of stainless steel or brass, suitably attached to the pump. Data plates shall contain the manufacturer’s name, pump size and type, serial number, speed, impeller diameter, capacity and head rating and other pertinent data.

9. Balance and Vibration
   a. Balance and vibration shall meet NEMA Standards MG1-12.05 and MG1-12.06.

D. LEVEL CONTROLS

1. Three non-mercury float type switches shall control the duplex pump control system. The float switches shall be sealed in a corrosion resistant polypropylene housing. Float switches shall be NEMA 6 rated. The wire shall be a minimum of 18-2 SJOW jacket cable.
2. The cable shall be of length necessary to extend from float switches to control panel with no splices.

3. Level control shall be UL / CSA Listed

E. SUMP- PUMP CONTROL PANEL

1. General
   a. Contractor shall furnish all labor, materials, equipment and incidentals required to provide a simplex motor control panel for the pumps. The control system shall start, stop system, provide oil sensing/monitoring and provide trouble alarm. The oil sensing system shall shut down pump upon detection of oil. The control system shall also provide indications of pump’s operation.

   b. The motor control panel shall be assembled and tested by a shop meeting UL Standard 508 for industrial controls. The motor control panel shall be assembled and tested by the same manufacturer supplying the pumps so as to insure suitability and assurance of experience in matching controls to motors and to insure single source responsibility for the equipment.

2. Construction
   a. The controls for the pump shall be contained in a NEMA 4X, constructed of fiberglass reinforced polyester with a matched raised cover (door). Require hinged door and neoprene gasket.

   b. The enclosure shall have stainless steel padlock hasp. A nameplate shall be permanently affixed to the panel and include the model number, voltage, phase, hertz, ampere rating and horsepower rating. A warning label against electric shock shall be permanently affixed to the outer door. All fasteners shall be 300 series stainless steel. The outer cover (door) shall be attached to the enclosure using stainless steel hinges.

   c. A painted steel back panel shall be provided, or approved equal. The back panel shall be mounted on stainless steel bolts using stainless steel nuts and lock washers to maintain enclosure integrity and shall be used as the means for mounting the components in the enclosure.

   d. For each pump an amber run pilot light, a green pump
running light and a hand-off-auto switch shall be provided. Lights and hand-off-auto switches shall be mounted on front cover (door). The lights and hand-off-auto switches shall be properly labeled identifying the function for the switch or lights.

e. The System shall have a high level alarm. Provide a NEMA 4 audible alarm with test button and silence button in addition to the visual. Coordinate with Septa as to the appropriate location.

PART 3 EXECUTION

3.01 INSPECTION

A. Condition of Rough-Ins: Inspect rough-ins and determine exact drain location with respect to the Contract Drawings.

B. Do not proceed until floor drain positions are verified, or any adjustments in fixture locations are approved by the Project Manager.

3.02 PERFORMANCE

A. Installation Instructions: Install Products, equipment and appurtenances in strict accordance with manufacturer's installation instructions and at locations indicated on the Contract Drawings.

3.03 PUMP CONNECTIONS

A. Install piping adjacent to sump pumps to allow service and maintenance.

B. Ground equipment according to Division 16 Section "Grounding and Bonding."

C. Connect wiring according to Division 16 Section "Conductors and Cables."

3.04 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify bearing lubrication.
3. Disconnect couplings and check motors for proper direction of rotation.

4. Verify that each pump is free to rotate by hand. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.

5. Verify voltage and frequency per the nameplate data. Test motor and cable insulation for moisture content. Vibration test motor. Provide written report to Septa indicating all tests have been performed and pumps have performed properly.

6. Verify that pump controls are correct for required application.

B. Start pumps without exceeding safe motor power:
   1. Start motors.
   2. Open discharge valves slowly.
   3. Check general mechanical operation of pumps and motors.

C. Test and adjust controls and safeties.

D. Remove and replace damaged and malfunctioning components.
   1. Pump Controls: Set pump controls for automatic start, stop, and alarm operation as required for system application.
   2. Set field-adjustable switches and circuit-breaker trip ranges as indicated, or if not indicated, for normal operation.

E. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project outside normal occupancy hours for this purpose.

END OF SECTION
SECTION 15441

SEWAGE EJECTOR PUMPING STATION AND CONTROLS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. It is the intent and purpose of this specification to cover and include under each item the supplying of all materials, equipment, apparatus, and all other accessories as described herein to purchase one (1) fully operational duplex grinder submersible pumping station.

B. Any equipment, apparatus, material, or small items not mentioned in detail and not hereinafter specifically mentioned which may be found necessary to complete or perfect any portion of detailed equipment shall be furnished without extra cost to SEPTA excluding discharge piping and miscellaneous valving.

C. Furnish a non-clog submersible pumping station with all accessories as specified herein.

1.02 SUBMITTALS

A. The supplier shall submit six (6) copies of the following items.

1. Shop drawings, catalog cuts, illustrations, specification schedule and material lists showing complete details of all proposed equipment for approval prior to manufacture or ordering of said item.

1.03 CODES, REGULATIONS AND REFERENCE STANDARDS

A. All work described under this specification shall be done in accordance with the latest applicable Federal, State, and Local Codes, Laws, Ordinances, Rules, Regulations and Reference Standards.

1.04 DELIVERY OF EQUIPMENT

A. The supplier shall notify SEPTA at least three days prior to the delivery date of the equipment. The pumping station, controls and accessories shall be delivered to SEPTA at the time and location as specified in the bid documents.
1.05 OPERATION AND MAINTENANCE MANUALS

A. The supplier shall furnish SEPTA with three (3) complete copies of the following manuals in hard cover three ring binders:

1. Installation Instructions
2. Operating Instructions
3. Maintenance and Service
   a. Maintenance Schedule
   b. Trouble-Shooting Guide
   c. Disassembly, Repair and Reassemble.
   d. Alignment, Adjusting and Checking
4. Parts List

1.06 TESTING AND FINAL INSPECTION

A. The supplier shall provide the services of a factory-trained representative for start-up, field test, and calibration of pump control.

1.07 ACCEPTANCE AND WARRANTY

A. The pumping station and control’s manufacturer shall warrant in writing that its entire package shall be free of defects in design, materials and workmanship, for a period of twelve (12) months from the date of final equipment acceptance, under normal use and service.

B. Should some components be supplied or assembled by the vendor/distributor, the vendor/distributor shall warrant in writing that all supplied or assembled components shall be free of defects in design and system integration, materials and workmanship for a period of twelve (12) months unless a longer period standard warranty is offered by the equipment manufacturer.

C. Final equipment acceptance shall occur following the installation and successful operation of the equipment, but shall not exceed a period of 18 months from the date of receipt.
1.08 INITIAL AND FINAL OPERATING INSTRUCTIONS

A. The supplier shall provide SEPTA operation and maintenance personnel with six (6) hours of training (excluding travel time) on the operation and maintenance of the equipment supplied.

1.09 QUALIFICATION OF PUMPING STATION

A. The pumping station and controls supplier shall be a local (50 mile radius) authorized distributor/selling agent with minimum 5 years experience in furnishing and servicing pumps and controls. Service is to be local and provided only by the authorized factory representative.

B. Documentation must be provided with the bid package from the manufacturer on their letterhead that the pumping station supplier is authorized to sell and service the non clog submersible pump(s) furnished and that the pump(s) offered are current production models. Failing to do so will result in disqualification.

C. The submersible pump and controls manufacturer must be a leader in the field of pumping technology. The pumping station must be completely factory assembled by the manufacturer.

PART 2 PRODUCTS

2.01 SEWAGE EJECTOR PUMP

A. General:

1. The sewage ejector pumps shall be duplex grinder type. Acceptable Manufacturers:

   a. F.E. Myers Company Supplied by Mid Atlantic Pump Phone No. 856-768-3880

   b. Or Approved Equal

B. Pump Characteristics

1. The new pumps shall conform to the capacities, pumping heads, minimum heads, and minimum efficiencies as stated below.

2. The pumps shall be designed to handle raw unscreened water. The discharge connection elbow shall be permanently installed in the sump along with the discharge piping. The pump(s) shall be automatically connected to the discharge
connection elbow when lowered into place, and shall be easily removed for inspection or service. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pump unit shall be guided by guide bars and shall press tightly against the discharge connection elbow. Sealing of the discharge interface will be accomplished by hydraulic sealing. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity.

3. Refer to drawings for operating and electrical characteristics.

C. Construction

1. General

   a. Pump shall be vertically mounted centrifugal, volute-type, single suction, grinder submersible type designed to operate in a completely or partially submerged situation and be capable of macerating all material in normal domestic and commercial sewage. Pump shall be non-overloading through the entire range of operation without employing a safety factor.

   b. Pump volute, motor and seal housing shall be high quality gray cast iron, ASTM A-48, Class 30. The pump discharge shall be fitted with a standard 1 ‘4” NPT connection. All external-mating parts shall be machined and Buna N Rubber 0-ring sealed on a beveled edge. Gaskets shall not be acceptable. All fasteners exposed to the pumped liquids shall be 300 series stainless steel.

2. Electrical Power Cord

   a. Electrical power cord shall be #14-4 type SOOW-A, four conductors, while the motor control cord shall be #18-5 type SOOW, five conductors. Sufficient cord length shall be used so that the pump may be removed without disconnecting power and control wires from junction box. Cord lengths shall be such that no splices will be required between the pump and junction box at the top of the basin.

   b. The pump shall be triple protected with a compression fitting and two epoxy potted areas at the power cord.
entry to the pump. A separation between the junction box area of the pump and the motor by a stator lead sealing gland or terminal board shall not be acceptable.

c. The cord cap assembly where bolted to the connection box assembly and the connection box assembly where bolted to the motor housing shall be sealed with a Buna N Rubber 0-ring on a beveled edge to assure proper sealing.

d. Stainless steel cable support shall be provided, and shall be a wire braid sleeve with attachment tails for connection to the underside of the access frame.

3. Motor

a. The pump motor(s) shall be of the submersible type rated for 2 horsepower at 3450 rpm. Motor shall be single phase, 230 volt, 60 hertz. Single motors shall be of a permanent split capacitor run type for high starting torque with no relays or starting switches. The stator winding shall be open type with Class F insulation rated for 3 11°F (155 °C) maximum operating temperature. The winding housing will be filled with clean dielectric oil that will lubricate bearings, seals and transfer heat from the windings to the outer shell. The motor stator is to be pressed into the motor housing for optimum concentricity and alignment, and maximum heat transfer. Pump motors without press fit housings will not be acceptable. The motor shall be capable of operating over a full range of the performance curve without overloading motor and causing any objectionable noise or vibration. The motor shall have three bearings to support the rotor; an upper ball bearing to accommodate thrust loads, an intermediate ball bearing to take radial loads, and a sleeve bearing in the seal chamber to prevent shaft deflection at the lower seal from radial shock loading of the impeller. Ball bearings shall be designed for a LB-10 life (50,000 hours). All motors shall be of domestic manufacturer and shall incorporate US made materials including castings, windings, etc. Motors not manufactured in the Continental United States will not be considered. Verifications of US manufacture including foundry certification shall be supplied to the SEPTA PM at his or her request.

b. The Pump shall be equipped with heat sensors. A heat
sensor thermostat shall be attached to the top end of the motor windings and shall be connected in series with a holding relay in the control box to stop the motor if the motor winding temperature reaches 221 °F. The high temperature shutoff will cause the pump to cease operation, should a control failure cause the pump to run in a dry sump. The thermostat shall reset automatically when the motor cools to a safe operating temperature.

4. Bearings and Shaft
a. An upper radial bearing and a lower thrust bearing shall be required. These shall be heavy-duty single row ball bearings, which are permanently lubricated by the dielectric oil, which fills the motor housing. Double row, sealed grease packed bearings shall not be acceptable. Bearings which require lubrication according to a prescribed schedule shall not be acceptable.

b. The common motor pump shaft shall be of 416 stainless steel and shall be heat shrunk into the die cast motor rotor. Rotor shaft shall be supported by a lower ball bearing to take thrust and radial loads and by an upper bronze sleeve bearing to take radial load only.

5. Seals
a. The pump shall have two mechanical seals, mounted in tandem, with an oil chamber between the seals. Seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The lower seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present on the backside of the impeller to keep contaminants out of the seal area. Units which require the use of tungsten-carbide seals or foreign manufactured seals shall not be acceptable. Seals shall be locally available.

b. The pump shall be equipped with a seal leak detection probe and warning system. This shall be designed to alert maintenance personnel of lower seal failure without having to take the unit out of service for inspection or requiring access for checking seal chamber oil level and consistency.

c. There shall be an electric probe or seal failure sensor.
installed in the seal chamber between the two tandem mechanical seals. If the lower seal fails, contaminants which enter the seal chamber shall be detected by the sensor and send a signal to operate the specified warning device.

d. Units equipped with opposed mechanical seals shall not be acceptable.

6. Impeller

a. Impeller shall be of the two-vane, enclosed non-clogging design and have pump-out vanes on the backside of the impeller to prevent grit and other materials from collecting in the seal area. Single vane design impellers are not acceptable. Impeller shall not require coating. Impeller shall be recessed type, dynamically balanced and constructed of 85-5-5-5 bronze.

b. The impeller shall be threaded onto the stainless steel shaft. A 300 series stainless steel washer and impeller bolt shall be used to fasten the impeller to the shaft.

7. Grinder Construction

a. Grinder assembly shall consist of grinder Impeller and shredding ring and shall be mounted directly below the volute passage. Grinder impeller to be threaded onto a stainless shaft and shall be locked with screw and washer. The shredding ring shall be pressed into iron holding flange for easy removal. Flange shall be provided with tapped back off holes so that screws can be used to push the shredding ring from the housing. All grinding shall be from the action of the impeller against the shredding ring.

8. Casing

a. The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load.

9. Data Plates and Hardware

a. Data Plates: All data plates shall be of stainless steel or brass, suitably attached to the pump. Data plates shall contain the manufacturer’s name, pump size and type,
serial number, speed, impeller diameter, capacity and head rating and other pertinent data. A special data plate shall be attached to the pump frame, which shall contain identification of frame and bearing numbers.

b. Hardware: All machine bolts, nuts and cap screws shall be stainless and of the hex head type. Hardware or parts requiring special tools or wrenches shall not be used.

10. Balance and Vibration

a. Balance and vibration shall meet NEMA Standards MG1-12.05 and MG1-12.06.

2.02 FIBERGLASS BASIN ASSEMBLY

A. Basin

1. The basin shall be 48” diameter by 108” deep. The basin shall be fiberglass polyester resin saturated glass filament wound process technique to assure that the interior surface is smooth and resin rich free of cracks, exposed fibers, porosity and crazing and able to obtain maximum axial and hoop modulus strength.

2. The basin shall have a minimum wall thickness of three eighths inch (3/8”) the basin wall shall be designed to withstand a wall collapse based on the assumption of hydrostatic type loading by back fill with minimum density of 120 pounds per cubic foot. The basin wall laminate shall be constructed to withstand or exceed two times the assumed loading for any depth of basin.

3. The basin bottom shall be sufficient thickness to withstand applicable hydrostatic uplift pressure with a safety factor of two. In saturated conditions, the center deflection of the empty basin bottom shall be less than 3/8” (elastic deflection) and shall not interfere with bottom pump mounting requirements.

4. Anti flotation means shall be provided with each basin. A fiberglass anti floatation collar shall be provided as an integral part of the 48” diameter basin. The anti floatation collar shall extend a minimum of 3” beyond the outside diameter of the basin wall. The plate shall have holes for securing basin to an anti flotation base.

5. Corrosion resistant nuts shall be embedded in the top flange of the basin for securing the basin cover. A minimum quantity
of six (6) shall be provided. The nuts shall be totally encapsulated in the fiberglass to prevent turning and for corrosion resistance.

B. Basin Cover

1. The cover shall be 1/4” thick aluminum diamond plate construction designed to support a 300 lb./s.f. live load with deflection of 11150th of span. The frame shall be extruded aluminum with an integral anchor flange and seat. The access cover shall be equipped with a flush aluminum drop handle which does not protrude above the cover and an automatic hold open arm. Hatch inside cover shall open 90 degrees and automatically lock in that position with a stainless steel hold-open arm with red vinyl grip. The hatch door shall be equipped with a removable lift handle, stainless steel and snap lock. The frame shall be extruded aluminum. All hardware shall be stainless steel. Hinges shall be stainless steel with stainless steel pins and tamper proof fasteners. The cover shall have six (6) minimum ‘A” mounting holes drilled around the perimeter for field mounting to the basin with stainless steel cap screws. Cadmium plated nuts for the screws shall be embedded in the fiberglass to prevent turning and for corrosion resistance.

C. Shutoff Valve

1. A PVC true union ball type shutoff valve with teflon seats shall be furnished and installed in the discharge piping. If the discharge depth is more than 2 feet from the surface, a handle extension shall be supplied.

D. Piping

1. Schedule 80 PVC discharge piping shall connect to the stationary discharge base lift assembly and terminate at a 1 ¼ “(Female) NPT discharge fitting mounted on the basin at the height shown on drawing attachment “A”.

E. Rail Assembly

1. A lift-out rail assembly shall permit easy removal and installation of the pump and lower check valve without the necessity of personnel entering the basin. Structural guide brackets with guide yokes of sufficient bearing strength to prevent binding shall bolt to each pump. The yokes shall mate over guide rails of a minimum of 1” fiberglass pipe running between an upper rail support and discharge case. A shoulder
on each nozzle shall bottom on the discharge case to insure alignment for a leak tight seal. Dual "0" rings shall affect a hydraulic seal around each nozzle when it is in its operating position. A brace, easily removable from the top of the basin, shall be provided to lock the parts together, preventing line surges from breaking the seal and allowing leakage. The discharge case shall have a discharge opening with piping to a discharge coupling through the basin wall.

2. A lifting chain shall be securely fastened to the top of the pumps and to the top of the basin to facilitate removal of the pumps. The chain shall be a minimum of ¼" welded link type, or of adequate strength, required to effectively support the weight of the pump assembly while removing and installing.

F. Check Valve

1. The lift out check valve shall be of the ball type with a corrosion resistant neoprene ball. The ball shall be the only moving part and shall move automatically out of the path of flow, thus providing an unobstructed smooth flow through the valve body. Upon pump shut-off the ball shall automatically roll to the closed position to provide a positive seal against back pressure or back flow.

2. The elbow / check valve shall be bolted to the pump. A simple downward sliding motion of the pump and guide plate on the guide rails shall cause the unit to be automatically connected and sealed to the base. The discharge flange seal shall provide a leak proof seal at all operating pressures.

G. Inlet Connection

1. A basin inlet flange for 4” C.I. pipe shall be included, but not mounted on the basin. The flange to be mounted in the field at inlet height required by the installation, or as shown on the drawing attachment "A". The flange shall be furnished with a gasket to seal between the basin and flange and also include mounting bolts.

H. Vent Connection

1. A 2" NPT (female) Bulkhead fitting shall be included, but not mounted on the basin. The fitting to be mounted in the field at the height required by the installation, or as shown on the drawing attachment "A". The fitting shall be furnished with a gasket to seal between the basin and fitting. Supply a 2" mushroom cap for vent pipe.
2.03 SUBMERSIBLE PUMP CONTROL PANEL

A. General

1. Contractor shall furnish all labor, materials, equipment and incidentals required to provide a duplex motor control panel for the pumps.

2. The motor control panel shall be assembled and tested by a shop meeting UL Standard 508 for industrial controls. The motor control panel shall be assembled and tested by the same manufacturer supplying the pumps so as to insure suitability and assurance of experience in matching controls to motors and to insure single source responsibility for the equipment.

B. Construction

1. The controls for the pump shall be contained in a NEMA 4X, constructed fiberglass reinforced polyester with a matched raised cover (door). Require hinged door and neoprene gasket. A phenolic plate with 1/2 inch high white lettering, cut through a black background shall be provided on the face of the control panel to identify the pump being controlled.

2. The enclosure shall have stainless steel snap latches featured with a padlock hasp. A nameplate shall be permanently affixed to the panel and include the model number, voltage, phase, hertz, ampere rating and horsepower rating. A warning label against electric shock shall be permanently affixed to the outer door. All fasteners shall be 300 series stainless steel. The outer cover (door) shall be attached to the enclosure using a continuous stainless steel hinge.

3. A steel back panel with electroplated bright zinc and clear chromate finish shall be provided, or approved equal. The back panel shall be mounted on stainless steel bolts using stainless steel nuts and lock washers to maintain enclosure integrity and shall be used as the means for mounting the components in the enclosure.

4. For each pump a green run light, an amber run pilot light, red seal failure light, a hand-off-auto switch shall be provided and a elapsed time meter. Lights, timers and hand-off-auto switches shall be mounted on front cover (door). The lights, timers and hand-off-auto switches shall be properly labeled with phenolic plates with 1/4 inch high white lettering, cut through a black background identifying the function for the
5. The System shall have a high level alarm with a visual red light that will flash, and will also have an audible exterior alarm which can be shut off by pressing a silence push button.

6. The incoming power shall be 230 volts, 1 phase, 60-hertz service. Thermal blocks with box type lugs shall be supplied to terminate all wiring for liquid level controls and heat and seal sensors for the pump. The pump leads shall be terminated at the overload relay or at box type terminal blocks.

7. A circuit breaker shall be used to protect from line faults and to disconnect the pumps from the incoming power. Circuit breakers shall be thermal magnetic and sized to meet NEC requirements for motor controls.

8. A reduced voltage magnetic starter shall be provided within the control panel.

9. Control voltage shall be 120 VAC. A control fuse and on/off switch shall protect and isolate the control voltage from the line.

10. Wire ties shall be used to maintain panel wiring in neat bundles for maintenance and to prevent interference with operating devices. All wiring shall be color coded to facilitate maintenance and repair of the control panel. Where a color is repeated, number coding shall be added. A schematic shall be permanently attached to the inside surface of the front door.

11. All ground connections shall be made with ring tongue terminals and star washers to assure proper ground.

12. Panel shall contain the necessary logic for connecting heat sensor monitors and seal failure probe/relays to box type lug connectors.

13. The system shall be equipped with an automatic alternator with elapsed time meter to alternate pumps for equal run time.

14. Box type lug connectors shall be made of polyamide thermoplastic to exclude aging due to heat influences.

C. Options

1. Panel shall be equipped with the following additional features.
2.04 MOTOR STARTERS

A. Motor starters shall be supplied with the following components.

1. Magnetic non-reversing. It shall be capable of six (6) starts per hour on a continuous 24-hour basis in a 104 degrees Fahrenheit ambient temperature. The manufacturer shall certify and guarantee that the starter provided as described below is capable of operating on the duty cycle basis previously stated. The starters shall be equipped and wired with the following for each pump motor.

   a. Starting contactors with auxiliary relays and interlocks
   b. Running contactors with auxiliary relays and interlocks.
   c. Overload relay.
   e. Terminal block for external wiring connections.
   f. Elapsed time meter, with no reset and range of 99999.9 hours. It shall be numbered wheel type. The numbers shall have minimum height of 3/16”. The meter shall be door mounted.
   g. Starter shall be completely wired internally by the manufacturer.

2.05 LIQUID LEVEL CONTROL AND ALARM SYSTEM

A. Level Controls

1. Four non-mercury float type switches shall control the duplex pump control system. The float switches shall be sealed in a corrosion resistant polypropylene housing. Float switches shall be NEMA 6 rated. The wire shall be minimum of 18-2 SJOW jacketed cable.

   2. The cable shall be of sufficient length to reach the junction box with no splices. The level controls shall be suspended
from a stainless steel bracket so that adjustment or replacement may be done without the use of any tools.

3. Level controls shall be UL/CSA listed.

B. Junction Box

1. The junction box shall be constructed of structural plastic for corrosion resistance, stability and mechanical strength. The enclosure shall be of adequate thickness and properly reinforced to provide good mechanical strength. The junction box shall have a fully gasketed cover that is held in place by four (4) captive stainless steel screws that can not be removed from the cover, with heads totally encapsulated in PVC so that no metal parts are exposed. The screw heads shall be of adequate size so that they may easily be installed and removed without the use of special tools. The cover shall be fastened to the main body of the junction box by means of a totally corrosion resistant tether, to prevent dropping the cover into the basin during service.

2. An adequate number of sealing type cord grips shall be supplied for incoming pump and level control cords. The cord grips shall be made of non-corrosive material, such as PVC or nylon, and shall make an effective seal around the wire jacket. The cord grip shall also seal to the junction box wall with “O” ring, or gasket.

3. The junction box shall have a PVC solvent weld socket type conduit hub. The hub shall be of a corrosion resistant material and shall be of adequate size to accommodate the number of wires required to operate the pump.

4. A method for sealing the incoming wires shall be supplied so that condensation from the conduit or ground water will not enter the enclosure. The sealing method shall be offered as a kit containing all necessary mixing measuring, stirring and potting material required for an effective infield seal. The interior of the enclosure shall be of adequate size to accommodate the wires and connections required to operate the pump.

5. The junction box shall be designed to NEMA 6 standards for occasional submergence.

6. The wires running between the control panel and the junction box shall be colored-coded and fastened to the pumps and level controls by means of adequately sized and insulated
2.06 AUTOMATIC DIALING ALARM SYSTEM

A. The monitoring system shall be microprocessor based and have the capability to monitor 2, 4 or 8 dry contacts /digital input with the option to include 2 analog inputs and 1 relay output. Each of these dry contacts inputs shall be user configured through the front panel as normally- closed or normally- open. In addition, the monitoring / alarm system shall monitor the AC power and battery voltage continuously. Upon detecting an alarm on any of its inputs, a low battery condition or detecting loss of its AC power, the system shall begin dialing the first of up to 8 user- programmed telephone numbers.

B. The monitoring / alarm system shall speak user- recorded messages to the called party describing its location and the alarm conditions that are present. The monitoring / alarm system shall then verbally request that an acknowledgment be given. The called party shall acknowledge the call by momentarily depressing the “9” key on the telephone keypad.

C. If the system is not acknowledged during the call, it shall hang up, if a successful acknowledgment occurs, the system shall give a sign - of message, allow access to program the system and hang up and then wait a user - programmed period of time for the alarm conditions to be corrected. If this period of time elapses and the alarm conditions still exist, the system shall begin the alarm notification cycle again.

D. The monitoring / alarm system shall support a relay output that shall remain energized as long as the system has any unacknowledged alarms. This output shall be available to allow for wiring to an external horn, buzzer, light or other local alarm device. Additionally the user shall be able to remotely activate / deactivate the relay from a telephone keypad.

E. Construction

1. For Flush mounting or sub-panel mounting configuration, in a NEMA 4X enclosure.

2. Environmental limits shall be as follows:
   a. Temperature: 32 °F to 158 °F
   b. Humidity: 0-90% non-condensing at 140 °F
3. Power Requirements: 9-12 VDC by supplied 115 VAC

4. Dimensions: 10" W x 12" H x 6" D

5. Weight 1.8 pounds

6. Electronic Protection: Solid state surge protection provided on digital input, analog input, serial port, and telephone circuitry. All fuses shall be solid-state automatic reset table requiring no maintenance.

7. Wiring: All 110 wiring shall use quick-disconnect pluggable connectors.

8. Digital Inputs: Dry contact/digital input cards shall be capable of interfacing directly to dry contacts or digital input signals with voltages up to 24 volt DC.

9. Analog Inputs: Analog input cards shall be capable of interfacing directly to 4-20 ma, 0-20 ma, 0-5 volt, 1-5 volt signals. Each channel shall be programmable for range independently from any other channel on the same board. All channel range programming shall be via the keypad.

10. Relay Output: The relay shall be programmable to activate automatically when any channel goes into alarm, or upon local or remote request. The relay shall deactivate automatically when all channels have returned to the normal condition, upon a programmable timer expiring or upon local or remote request.

F. Performance Specifications

1. Telephone Number: 8 numbers up to 25 digits each may include '*', '#', delays, and detection of dial tone.

2. Recorded Speech Capacity: 5 seconds per input channel message and system identification message.

3. Monitoring Capacity: 2, 4 or 8 dry contact and 2 or 4 analog inputs optional.

4. Speech Technology: Digitally recorded voice message plus permanent library.

5. Message Requirements: Alarm messages for power failure, low battery and individual 5 second user recorded messages for each input channel and system identification.
6. Local Programming: The system shall be programmable from the front integral keypad with programming prompts displayed on the integral LCD display.

7. Remote Programming: The system shall be remotely programmable from a phone call in. The user shall be able to program the telephone numbers, user messages, change the channel mode between call on alarm and statue only.

8. Remote Control: The system shall allow a user to activate / deactivate the optional relay remotely.

9. Types of Alarms: The monitoring / alarm system shall have the following separate alarm types:
   a. System: - loss of primary power and low battery
   b. Digital: - on or off for a specified period of time
   c. Analog: - a user specified high or low limit for a specified period of time, all alarms shall be recorded with data / time in the event log. All alarms shall be recorded with data / time in the event log.

10. Alarm Acknowledgment: The system shall provide acknowledgement of alarms from:
   a. Front panel
   b. Phone that is called with an alarm condition
   c. Dial in from a remote location with appropriate access codes. All acknowledgements will be recorded in the event log with the date / time of the acknowledgement, the method of acknowledgement.

11. Status Reporting: A report of all current conditions of the system shall be available when the system is called. The report shall include the name of the unit and current state of all channels.

12. Event Reporting: The system shall have the capability of documenting all alarms, dial out, dial in, and alarm acknowledgement and relay activations. The event report shall contain the last 100 events. Each event shall have the date / time of the event and the action performed. The event log is accessible locally via the keypad and display or remotely by phone.
13. Data Logging: The system shall record daily motor / pump run times, cycles and totalized flow for channels that these settings have enabled.

14. Channel Mode: Each channel shall be individually programmed for alarm notification or status only.

15. Alarm Notification: The system shall be capable of notifying of alarm conditions to a phone or digital pager.

16. Arming and Disarming: The system shall be capable of being armed or disarmed manually or remotely. Arming or disarming shall be recorded to the event log.

17. Listen In: Integral microphone shall allow user to listen in to the remote site during call in.

18. Battery Backup: The system shall have internal battery backup capacity sufficient for an 8 — channel monitoring / alarm system to perform its alarm call out function for a minimum of 12 consecutive hours upon loss of primary power.

19. Certifications: The monitoring / alarm system shall meet FCC part 15, Class A, have valid FCC registration number per part 68, have industry Canada registration number and CE Mark

20. Manufacturer: Automatic dialing monitor / alarm system shall be Dialog Scout as manufactured by Antx, or approved equal

21. Warranty: Two years of warranty shall be standard with the purchase of a new unit.

2.07 PAINTING
A. Pumps, motors, and all appurtenances shall receive both prime and finish coats of epoxy paint at the factory.

2.08 MANUFACTURER’S WRITTEN CERTIFICATION:
A. The manufacturer will submit four (4) copies of written certification verifying that each complete pumping system (pumping units, bases, sealing flanges, lifting chains, rails, level controls, alarms, floats, pump controls, pump cables and appurtenant parts) provided for this contract has been successfully factory tested to full design load capacity, has been installed and is operating in accordance with these contract documents and the manufacturer’s specifications, and has been successfully tested by the manufacturer or his appointed representative
B. The manufacturer will submit four (4) copies of stamped standard performance curve for each pump, meeting manufactures certified hydraulic performance test.

PART 3  EXECUTION

3.01  INSPECTION

A. Condition of Rough-Ins: Inspect rough-ins and determine exact drain location with respect to the Contract Drawings.

B. Do not proceed until floor drain positions are verified, or any adjustments in fixture locations are approved by the Project Manager.

3.02  PERFORMANCE

A. Installation Instructions: Install Products, equipment and appurtenances in strict accordance with manufacturer's installation instructions and at locations indicated on the Contract Drawings.

3.03  PUMP CONNECTIONS

A. Install piping adjacent to pumps to allow service and maintenance.

B. Ground equipment according to Division 16 Section "Grounding and Bonding."

C. Connect wiring according to Division 16 Section "Conductors and Cables."

3.04  STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Verify bearing lubrication.

3. Disconnect couplings and check motors for proper direction of rotation.

4. Verify that each pump is free to rotate by hand. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
5. Verify voltage and frequency per the nameplate data. Test motor and cable insulation for moisture content. Vibration test motor. Provide written report to Septa indicating all tests have been performed and pumps have performed properly.

6. Verify that pump controls are correct for required application.

B. Start pumps without exceeding safe motor power:
   1. Start motors.
   2. Open discharge valves slowly.
   3. Check general mechanical operation of pumps and motors.

C. Test and adjust controls and safeties.

D. Remove and replace damaged and malfunctioning components.
   1. Pump Controls: Set pump controls for automatic start, stop, and alarm operation as required for system application.
   2. Set field-adjustable switches and circuit-breaker trip ranges as indicated, or if not indicated, for normal operation.

END OF SECTION
SECTION 15461
DOMESTIC WATER HEATERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Refer to division 1 sections for submittals and quality control.

B. Submit Product Data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories.


E. Listing and Labeling: Provide electrically operated water heaters, controls, and components specified in this Section that are listed and labeled.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Water Heaters, General: Manufacturer's components and features as specified and as shown on the drawings. Include the following:

1. Temperature Control: Adjustable thermostat,


3. Interior Finish: Materials that comply with requirements of applicable NSF, AWWA, or FDA and EPA regulatory standards for tasteless and odorless, potable-water-tank linings.

4. Tappings: Factory fabricated of materials compatible with tank. Include tappings for piping connections, relief valves, drain valve, and controls. Include tappings and connections as follows:
a. 2-Inch NPS (DN50) and Smaller: Threaded ends.


C. Jacket: Steel, with baked-on enamel finish, except where otherwise specified.

D. Anode Rods: Factory installed, magnesium.

E. Combination Temperature and Pressure Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3. Include relieving capacity at least as great as heat input and pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into tank.

2.02 STORAGE

A. Storage, Electric Water Heaters: UL 174, with capacity not less than 6 gal. (22.7 L), but not more than 75 gal., and input not more than 12 kW.

1. Storage Tank Construction: Steel with 150-psig (1035-kPa) working-pressure rating.

2. Heating Elements: 2, except when 1 is indicated; electric, immersion type.

3. Drain Valve: factory installed.

PART 3 EXECUTION

3.01 MECHANICAL INSTALLATIONS

A. Install water heaters on concrete bases. Set and connect units according to manufacturer's written instructions. Install units plumb, level, and firmly anchored in locations indicated. Maintain manufacturer's recommended clearances. Install so controls and devices are accessible for service.

B. Extend relief valve outlet with full size water piping in continuous downward pitch and discharge to closest floor drain.

C. Install water heater drain piping as indirect waste to spill into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains.

D. Install thermometers on water heater inlet and outlet piping.
E. Install piping adjacent to water heaters to allow service and maintenance.

F. Arrange for field-applied insulation on equipment and piping not furnished with factory-applied insulation.

G. Connect hot- and cold-water piping to units with shutoff valves and unions.

H. Make connections with dielectric fittings where piping is made of dissimilar metals.

I. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections.

J. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values.

END OF SECTION
SECTION 15530
FURNACES

PART 1  GENERAL

1.01  DESCRIPTION
A. This section includes the following:
B. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

1.02  SUBMITTALS
A. Submit Product Data for each furnace including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories according to the Conditions of the Contract and Division 1 Specification Sections.

PART 2  PRODUCTS

2.01  FURNACES, GENERAL
A. Factory assembled, piped, wired and tested.
   2. Cabinet: Steel with foil-faced, glass-fiber, interior insulation. Lift-out panels expose burners and all other items requiring access for maintenance.
   3. Finish of External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.
   4. Fan: Centrifugal, factory balanced, resilient mounted.
   5. Fan Motors: Multitapped, multispeed, with internal thermal protection and permanent lubrication.
B. Manufacturers: Subject to compliance with requirements, provide air-cooled condensing units of one of the following: Carrier Air Conditioning; York.; Trane Co.; or equal
2.02 GAS-FIRED FURNACES, CONDENSING


2. Type of Gas: Natural.

3. Efficiency: 93 percent AFUE, minimum.


5. Burner Controls: Solid state; control gas valve and ignition.
   a. Gas Valve: 100 percent safety gas shutoff; 24-V combining pressure regulation and manual off.
   b. Ignition: Electronic pilot ignition, with electric spark igniter.

6. Automatic Controls: Solid-state board delays fan start and fan shutdown.

2.03 CONTROLS

A. Include components required for satisfactory operation of furnaces and auxiliary in all seasons.

2.04 FILTERS

A. 1-inch thick, urethane, washable type in sheet metal rack.

B. 1-inch thick, disposable, fiberglass type in sheet metal rack.

2.05 EVAPORATOR COIL

A. Conform to ARI 210/240, “Unitary Air Conditioning and Air Source Heat Pump Equipment.” Match size with furnace. Match remote condensing unit specified in Division 15 Section “Condensing Units” with type, capacity pressure-drop ratings, restricted distributor, or expansion valve. Include condensate drain pan with accessible drain outlet.
2.06 EVAPORATOR COIL ENCLOSURE
A. As required to suit furnace and cooling coil. Steel cabinet with access panel and flanges for integral mounting at or on furnace cabinet.

2.07 REFRIGERANT LINE KITS
A. Annealed-copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; with insulated suction line and flared fittings at evaporator end; no fitting at condenser end; length as required.

PART 3 EXECUTION

3.01 FURNACE INSTALLATION
A. All equipment and material shall be installed in accordance with the manufacturer’s installation guidelines.

B. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

C. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

D. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

E. Controls: Install thermostats and humidistats at mounting height of 60 inches above floor.

3.02 CONNECTIONS
A. Coordinate piping installations and specialty arrangements with schematics on Drawings and with requirements specified. If Drawings are explicit enough, these requirements may be reduced or omitted.

B. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace
connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

D. Connect ducts according to Division 15 Section “Ductwork”.

E. Install piping adjacent to machine to allow service and maintenance.

F. Ground equipment.

G. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.04 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each furnace within 14 days after Substantial Completion.

END OF SECTION
SECTION 15670
CONDENSING UNITS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes the following:
   1. Air-cooled condensing units.

B. Capacity ratings for condensing units shall be in accordance with ARI Standard 360 “Standard for Commercial and Industrial Unitary Air-Conditioning Equipment.”

C. Refrigeration system of condensing units shall be in accordance with ASHRAE Standard ASHRAE 15 “Safety Code for Mechanical Refrigeration.”

D. Condensing units shall meet or exceed the minimum COP/Efficiency levels as prescribed in ASHRAE 90A “Energy Conservation in New Building Design.”

E. Condensing units shall be listed by UL and have UL label affixed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Air-Cooled Condensing units: Factory-assembled and tested, consisting of casing, compressors, condensers, coils, condenser fans and motors, and unit controls. Capacities and electrical characteristics shall be as scheduled.

B. Manufacturers: Subject to compliance with requirements, provide air-cooled condensing units of one of the following:
   1. Carrier Air Conditioning
   2. York
   3. Trane Co.
   4. Or equal
C. Compressor: Hermetic compressors with built-in overloads and vibration isolation. Compressor motor shall have, thermal and current sensitive overload device, internal high-pressure protection, high and low pressure cutout switches, start capacitor and relay, 2-pole contactor, crankcase heater, and temperature actuated switch and timer to prevent compressor rapid cycle.

D. Condenser: Coil shall have copper tubes and aluminum fins, or aluminum tubes and aluminum fins; provided with liquid accumulator and liquid subcooler. Aluminum propeller fan shall be direct driven, with permanently lubricated fan motor with thermal overload protection.

E. Accessories:
   1. Low-voltage thermostat and subbase to control condensing unit and evaporator fan;
   2. Precharged and insulated suction and liquid tubing of length indicated;
   3. Head pressure control to modulate condenser fan motor speed for low ambient conditions

F. Unit Casings: Designed for outdoor installation with weather protection for components and controls. Casings shall have removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features:
   1. Galvanized or zinc-coated steel for exposed casing surfaces, treated and finished with manufacturer’s standard paint coating.
   2. Units shall have lifting lugs to facilitate rigging of units.
   3. Metal grilles, factory-installed for protection of condenser coil during shipping, installation, and operation.

G. Condenser Fans and Drives: Propeller-type condenser fans for vertical air discharge; either direct drive or belt drive fans and motors. Include:
   1. Permanent lubricated ball bearing condenser fan motors.
   2. Separate motor for each condenser fan.
   3. Constant speed condenser fan motors.
H. Low Ambient Control: Low ambient damper assembly, fan speed control, or fan cycling control; factory-installed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of condensing units.

B. Examine roughing-in for refrigerant piping systems to verify actual locations of piping connections before equipment installation.

C. Examine walls, floors, and roofs for suitable conditions where condensing units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated; maintain manufacturer's recommended clearances.

B. Install condensing units on concrete base. Concrete materials and installation requirements are specified in Division 3.

C. Concrete Bases:

1. Install dowel rods to connect concrete base to concrete slab. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of the base.

2. For equipment supported on structural slab, install stainless steel anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

4. Install anchor bolts to elevations required for proper attachment to supported equipment.

5. Install anchor bolts according to anchor-bolt manufacturer's
written instructions.

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.03 CONNECTIONS

A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to machine to allow service and maintenance.

C. Connect refrigerant piping to air-cooled condensing units; maintain required access to unit. Install furnished field-mounted accessories.

D. Ground equipment according to Division 16 Section "Grounding and Bonding."

E. Connect wiring according to Division 16 Section "Conductors and Cables."

3.04 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. Perform electrical test and visual and mechanical inspection.

2. Leak Test: After installation, charge systems with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

5. Verify proper airflow over coils.
B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

C. Remove and replace malfunctioning condensing units and retest as specified above.

3.05 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for physical damage to unit casing.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

B. Lubricate bearings on fans.

C. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.

D. Adjust fan belts to proper alignment and tension.

E. Start unit according to manufacturer's written instructions and complete manufacturer's startup checklist.

F. Measure and record airflow over coils.

G. Verify proper operation of condenser capacity control device.

H. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

I. After startup and performance test, lubricate bearings and adjust belt tension.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Division 1 Sections "Closeout
Procedures" and "Demonstration and Training."

END OF SECTION
SECTION 15700
HEATING, VENTILATING AND AIR CONDITIONING

PART 1 GENERAL

1.01 DESCRIPTION
A. This section covers the general requirements for Heating, Ventilating and Air Conditioning work.

1.02 RELATED SECTIONS
A. Section 15060 - Hangers and Supports
B. Section 15670 - Condensing units
C. Section 15810 - Duct Work
D. Section 15838 - Fans

1.03 SCOPE OF WORK
A. General: Provide the following systems
   1. Heating
      a. Wall Mounted Unit Heater
      b. Baseboard Radiator
   B. Ventilation
      1. Exhaust Fan

1.04 DESIGN CONDITIONS
A. Design Temperature
   1. Winter
   2. Outside: $0°F$ DB
   3. Inside: Mech. Room $50°F$ DB
   4. Inside: Waiting Area / Office $72 °F$ DB
   5. Inside: Toilets Room $72 °F$ DB
6. Summer

7. Outside: 5 °F DB;

8. Inside: Air Conditioned Areas 75 °F DB; 50% RH

B. Ventilation Rates:

1. Toilets: Exhaust 75 CFM per water closet / urinal or 4 minutes air change with makeup air from adjacent spaces.

2. Waiting Area & Mech. Room: 15 CFM per person outdoor air minimum.

1.05 QUALITY ASSURANCE

A. Requirements Regulatory Agencies: the construction requirement and the design will be governed by the applicable codes in effect in the State of Pennsylvania except as supplemented by the design standards and practices adopted by SEPTA and the latest edition of the design standards listed below (SEPTA design standards and practices shall take precedence):

1. NEC Compliance: Comply with applicable heating terminal installation requirements of NEC pertaining to installation of space heating equipment and appliances.

2. UL Compliance: Comply with applicable requirements of UL 1042, “Electric Baseboard Heating Equipment”. Provide heating terminals which are UL-listed and labeled.

3. Air Conditioning and Refrigeration Institute AR! Compliance: Provide fan-coil ratings in accordance with AR! 440, “Standard for Room Fan-Coil Air Conditioners”.


5. International Mechanical Code

6. The American Society of Heating, Refrigeration, and Air Conditioning Engineers Handbooks (ASHRAE)


8. Air Movement and Control Association, Inc. (AMCA)
9. American Gas Association (AGA)
10. Gas Appliance Manufacturers Association (GAMA)
11. Energy Star - Guidelines for Energy Efficiency
12. Occupational Safety and Health Act (OSHA)
13. American National Standards Institute, Inc. (ANSI)

B. Source Quality Control: Products used throughout these Specifications are those companies having established reputations in the manufacture of the particular materials, equipment or apparatus specified. Such products shall be of their own make, or products of others, for which the manufacturer assumes full responsibility for products used in said outfits which are not manufactured completely by them; and with replacement parts available.

C. Workmen’s Qualifications: In acceptance or rejection of completed work, no allowance will be made for substandard work on the part of the Contractor’s forces performing such work.

1.06 SUBMITTALS

A. Submissions Required: Include Shop Drawings, manufacturer’s descriptive literature, catalog cut sheets and published details with performance / capacity rating schedules or charts as applicable in submissions. Product shop Drawings shall indicate fabrication details and proposed layouts for shop and field fabrications as named herein. Reproductions of Contract Drawings are not acceptable as Shop Drawings.

B. Submit Shop Drawings certified for construction by the manufacturer and approved by the Contractor which includes location of all connections; wiring diagrams; anchor bolt layout; details indicating construction and materials of construction; performance of equipment; dimensions and rated horsepower of all motors; service factors and weights of principal parts and completely assembled equipment. Submit Shop Drawings of all ductwork standards and details. Each ductwork Shop Drawing shall indicate type construction and its pressure class.

C. Samples: Submit 3 samples of each type of cabinet finish proposed.
D. Maintenance Data: Submit maintenance instructions, including lubrication procedures, filter replacement, motor and drive replacement, and spare parts lists. Include this data in maintenance manuals.

E. Equipment or Systems Requiring Manuals: Operating and maintenance manuals prepared by the manufacturer or Contractor are required for each of the items of equipment or systems listed in Part 2.

PART 2 PRODUCTS

2.01 PRODUCT QUALITY

Manufacturer’s products as listed herein are to establish the quality of the products desired. Provide either the listed or an approved equal.

2.02 WALL MOUNTED UNIT HEATER

A. Material and Equipment:

1. General: Furnish and install electric recessed heavy-duty fan forced wall heater, review Contract drawings for quantities. Manufacturer’s standard materials and components as indicated by published product information, TJL listed, designed and constructed as recommended by the manufacturer, and as required for a complete installation.

B. Heating Elements:

1. General: Except as otherwise indicated, provide manufacturer’s standard elements of the indicated duty and rated for the indicated capacity, consisting of 8 0/20 NiCh resistance wire, enclosed in a steel sheath, to which steel plate fins are brazed. The elements shall cover the entire air intake area to ensure uniform heating of all discharge air.

2. Electric Heating Capacity: 240 Volt / 1Ph

3. Performance Data: Size Room for 15 Watts per square foot, minimum of 1500 Watts.

C. Cabinets:

1. General: The heater section shall be prewired and consist of a 20-gauge galvanized steel chassis on which are mounted the heating elements, fan motor, blade, fan control, thermal cutout
and 3-pole contactor.

2. Cabinet Accessories: Furnish and install manufacturer's standard accessories of the following types; manufacturer's option if more than one type is indicated for each accessory.
   a. Removable inlet grilles to match discharge grilles.
   b. Tamper-proof panel fasteners consisting of either Allen head machine screws or spanner wrench operating can fasteners.
   c. Sub-bases.
   d. Each unit heater is equipped with a factory installed integral thermostat having an adjustment range of 45 °F to 95 °F.
   e. Each unit heater is equipped with a factory installed, integral fan delay switch to prevent discharge of cold air by delaying fan motor start until heating-elements have warmed up. This delay switch shall also delay fan motor stop unit until heating elements have been de-energized and dissipated any residual heat.
   f. Each unit heater is equipped with factory installed circuit breakers.

D. Cabinet Finish: Furnish factory finish of the following type:
   1. Baked enamel finish selected from manufacturer’s standard colors and as approved by the Project Manager.

E. Motors:
   1. General: Furnish and install permanent split capacitor motors, resiliently mounted, tap would with built-in thermal overload protection, and of the permanently lubricated type. Current characteristics:

      2. Permanently lubricated totally enclosed motor or provide extended motor oilers, plastic tubes terminating beneath the grille.

F. Fans:
   1. General: Furnish and install double width, double inlet centrifugal fans, balanced statically and dynamically, of the
indicated capacity. Connect fan to a single or double extended motor shaft, with fan, housing and motor mounted as an integral assembly on a motor board.

2. Construction:
   
a. Fan: Aluminum.

b. Housing: Galvanized steel.

c. Fan Panel: Galvanized steel.

d. Controls: Thermostatically controlled by an integral thermostat.

e. Acceptable Manufacturer: Subject to compliance with requirements, furnish and install Wall Mounted Heaters, following or approved equal:

   1) Qmark, Wall Mounted Heater
   2) Chromalox
   3) Indeeco
   4) Or equal

2.03 EXHAUST FAN

A. Description:

1. Duct mounted supply, exhaust or return fans shall be of the centrifugal, direct driven in-line type.

2. The fan housing shall be of the square design, constructed of heavy gauge galvanized steel and shall include duct mounting collar.

3. One side of the housing shall be equipped with a hingeable service door assembly supporting the motor, wheel and inlet cone.

4. The door assembly must swing out for cleaning, inspection, or service without dismantling the fan in any way.

5. The fan wheel shall be of the aluminum backward inclined centrifugal type. Wheels shall be dynamically and statically balanced. Fan motors shall be permanently lubricated, heavy-duty type carefully matched to the fan loads.
6. Flexible wiring leads shall be provided from the fan motor to a junction box and disconnect switch permitting the service door to be hinged without disconnecting the field wiring.

7. All fans shall bear the AMCA Certified Rating Performance Seal for both air and sound performance.

B. Acceptable Manufacturers: Subject to compliance with requirements, furnish and install Ceiling Fan of one of the following or approved equal:

1. Penn Ventilator - ZEPHYR
2. Cook
3. Greenheck
4. Or equal

C. Equipment Anchors: Provide anchors for mounting equipment. Size anchors as recommended by equipment manufacturers. When recommendations are not provided, size anchors to the largest diameter that will pass through the bolt holes in equipment bases.

D. Contractor shall provide all incidental and supplemental structural steel members, supports required for equipment and systems, including Gasket / Seal to prevent leakage when attached to ceiling.

2.04 BASEBOARD RADIATOR

A. Heating Elements – Stainless steel elements with aluminum fins float on high temperature nylon bushings for quiet operation.

B. Housing – Cabinet is constructed of 20-gauge steel with a 16-gauge steel front cover. The unit has a polyester powder paint finish in white or almond.

C. Inlet/Outlet Grilles – The fresh air inlet grille is located on the front of the unit. An extruded aluminum outlet grille discourages tampering with the heating element.

D. Built-in Controls – Linear limit, automatic reset thermal cutout.

E. Acceptable Manufacturers: Subject to compliance with requirements, furnish and install Baseboard Radiation of one of the following or approved equal:
1. Indeeco
2. Qmark
3. Chromalox
4. Or equal

PART 3 EXECUTION

3.01 WORK INCLUDED

A. Protective measures shall be required to cover Equipment from weather conditions prior to shipping to SEPTA.

B. Notify SEPTA in writing of any of the following conditions: damaged, missing, incomplete or incorrectly fabricated equipment or systems: improper rough - in work, utility stub - outs; obstructions or deficiencies that will impact the proper installation or action shall be subject to SEPTA's approval prior to performance of such action.

C. Inspect delivered equipment for damage from shipping and exposure to weather. Compare deliver equipment with packing lists and specification to assure receipt of all items.

D. Coordinate works with other trades to ensure proper equipment interfacing with the building structure and utilities.

E. Equipment and connections as shown on general arrangement drawing specified herein and as required making the equipment complete and operable. All of interconnections to be made by contractor.

3.02 INSTALLATION

A. Install equipment / systems in strict accordance with manufacturer’s installation instructions and recognized industry practices to insure that equipment / systems serve their intended function.

B. Employ qualified plumbers, electricians, HVAC technicians to install equipment. Installation is to be performed by firms and individuals with experience installing similar equipment.

C. All work shall be installed in a neat, workman — like manner in accordance with standard trade practice and to the satisfaction of SEPTA. Inferior work shall be replaced upon notification, without additional charges.
D. Install specified equipment at locations indicated on the contract drawings and accordance with the approval drawings and manufactures installation instruction.

E. Ensure that equipment is wired properly, with correct motor rotation, and positive electrical motor grounding.

F. Remove shipping bolts and temporary supports within equipment. Adjust as required for free operation.

G. Coordinate all work with work of roofing, walls, and ceilings, as necessary for proper interfacing.

H. Toilet room Exhaust Fan, to be switched simultaneously with toilet lighting on or off.

I. Comb out damaged fins where bent or crushed before covering heating elements with enclosures.

J. All equipment specified herein shall be anchored following manufacture recommendation. Equipment shall be attached securely to prevent damage resulting from inadequate fastening.

K. Clean dust and debris from each piece of equipment as it is installed to ensure cleanliness.

L. Upon completion of work, finish surfaces shall be free of tool marks, scratches, blemishes, and stains.

3.03 GROUNDING

A. Provide equipment-grounding connections, sufficiently tight to assure a permanent and effective ground, for heating terminals as indicated.

3.04 TESTING

A. Upon completion of installation of heating / air conditioning and after building circuitry has been energized, test to demonstrate capability and compliance with requirements. Where possible, field correct malfunctioning units, then retest to demonstrate compliance.

END OF SECTION
SECTION 15810

DUCTWORK

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes the following:
   1. The minimum requirements, acceptable materials, and methods of fabrication to be met by the Contractor in the design, supply, and erection of ductwork in conjunction with the equipment datasheets and the inquiry/PO (Purchase Order).

B. Related Sections:
   1. Division 15 sections as Included.

1.02 REFERENCES

A. AMCA (Air Movement and Control Association)
B. ASHRAE (American Society of Heating, Refrigerating, and Air Conditioning Engineers)
C. ASTM (American Society for Testing and Materials)
D. ISA (Instrument Society of America)
E. NEMA (National Electrical Manufacturers Association)
F. NFPA (National Fire Protection Association)
G. NEC (National Electric Code)
H. OSHA (Occupational Safety and Health Administration)
I. SMACNA (Sheet Metal and Air-Conditioning Contractors National Association):
   1. Air Duct Leakage Test Manual
1.03 SUBMITTALS

A. Outline drawings shall, as a minimum, show the following information:

1. Overall dimensions
2. Details of ductwork supports and sealing at joints
3. Materials

PART 2 PRODUCTS

2.01 GENERAL

A. Ductwork shall be fabricated of the materials indicated on project drawings.

B. Ductwork shall be securely anchored to the building, and shall be completely free from vibration. Installation and fabrication shall be in accordance with SMACNA industrial standards.

2.02 MATERIALS

A. The Contractor shall furnish all labor, materials, equipment, and supplies to fabricate and erect the duct systems specified including, but not limited to, the following items:

1. Ducts, turning vanes, flexible connections, and casings
2. Access doors
3. Fasteners
4. Hangers and bracing
5. Caulking
6. Collars

B. Galvanized steel ductwork and casings shall be in accordance with ASTM A525 and ANSI Coating Designation G-90, with a minimum coating weight of 1.25 ounces per square foot per side. Galvanized hot rolled steel shapes shall be used for bracing and hangers.

C. Aluminum ductwork and casings shall be constructed of first quality Type 3003-H14 aluminum sheets. Aluminum extrusions or shapes, Type 6061-T6, shall be used for bracing and hangers.
D. Where dissimilar metals are used or where metals would come into contact with the masonry or concrete, they shall be separated by 1/8 of an inch thick full width gasket of Neoprene, or approved equal, for temperatures of 150 degrees F and below; and 1/8 of an inch thick gasket of ethylene propylene rubber, or approved equal, for temperatures above 150 degrees F.

2.03 DESIGN

A. Ductwork

1. Curved elbows, with centerline radius no less the 1- 1/2 times the width of the duct, shall be used where space permits.

   Note: Width refers to the width in the plane in which the turn occurs.

2. Turning vanes shall be provided in all abrupt or square elbows. Turning vanes shall be of the double wall type with a trailing edge. A minimum of 2 vanes shall be used, arranged to permit the air to make the turn with as little turbulence or change in speed as possible. Vanes shall be flanged and spot-welded in place. All welds on galvanized material shall be touched up with galvicon paint.

B. Fasteners and Hangers

1. All fasteners and threaded hanger rods shall be Type 304 or 316 stainless steel. Threaded rods shall be no smaller than 3/8 of an inch in diameter.

2. Support for ducts shall be either by straps or by angle trapeze hangers of the same type material as the ductwork. Strap hangers shall be fastened to joint flanges where possible with at least 2 bolts. The strap shall be bent around the bottom edge of the flange or where installed between joints, and shall be bolted to the side and bottom of the duct.

3. Hangers shall be attached to the building structures according to the following:

   a. Structural Steel Building Hangers shall be attached by means of bolting to structural beams or from auxiliary steel angles attached to the beams.

   b. The hangers for ducts under poured-in-place slabs shall be fastened to the slab or to the sides of poured-in-place concrete beams with powder driven studs.
c. Hangers for precast concrete structures shall be attached by means of through bolting, using the holes provided in the structural beams.

Note: Under no circumstances shall powder driven studs be used in precast slabs.

4. The base angles of casing panels shall be lagged to the concrete curbs or pads with bolts in expansion shields or powder driven studs. All base angles shall be caulked on their high-pressure side.

5. Ducts shall be hung level and true to the elevations shown on the drawings.

6. Sway bracing shall be provided at the ends of all ducts, and at points of juncture of branch ducts and trunk ducts. Sway bracing shall also be provided at points no more than 30 feet on center along branch ducts. Trunk ducts shall have sway bracing at branch takeoffs only.

7. Ductwork shall be supported independently of fans, air conditioning cabinets, hoods, and other equipment.

C. Caulking and Sealants

1. Caulking, if required, shall be nonhardening mastic such as General Electric RTV silicone, or approved equal.

2. Caulking shall be applied in accordance with manufacturer’s recommendations to ductwork that has been thoroughly cleaned and dried.

D. Construction of Ductwork

1. Construction requirements for ductwork shall be in accordance with the Sheet Metal Gages and Construction Tables. Refer to Attachments 1, Sheet 1, 2, and 3. Additional duct construction details, if not specified, can be found in the latest issue of the applicable standards as published by SMACNA.

2. Longitudinal splice seams may be standing seam pocket lock or welded. Button snap lock shall not be permitted. Longitudinal seams shall be turned inside with the reinforcing as listed in the schedules. Pittsburgh lock seams for joining corners are not acceptable. Corners shall be formed metal with longitudinal splice seams as stated above.
3. Sealer shall be used on joints and seams that are not welded. Refer to Section C above.

4. Duct manufactured on a duct machine with beading reinforcement is not acceptable.

5. Ducts that must pass in front of, or too close to, equipment requiring access for servicing shall have flanged joints for easy removal of duct section. Provide extra duct hangers as required at these points.

6. All schedules attached are based on aluminum construction for ductwork, reinforcing, and hangers. When using galvanized or stainless steel as indicated on the construction drawings, the equivalent strength as compared to aluminum shall be used. These substitutions are listed in the Equivalent Thickness Schedule. Refer to Attachment 1, Sheet 4.

7. All sheet metal marked for breaking shall not be marked with a scribe. Tick marks or ink marks shall be used.

8. All panels of a duct section shall be of the same material type and gage.

E. Casings and Duct Panels

1. Noninsulated Casings
   a. Casings and seal sheets shall be fabricated into panels with companion angles gasketed and bolted together for easy disassembly. Panels shall not be greater than 3 feet wide. This applies to galvanized, stainless steel, and aluminum.
   b. The thickness of galvanized casings shall be no less than 0.052 of an inch with 1-1/2 inch by 1-1/2 inch by 1/4-inch minimum, galvanized companion angles.
   c. The thickness of aluminum casings shall be no less than 0.050 of an inch with 2 inch by 2 inch by 1/4-inch minimum, aluminum companion angles.
   d. Horizontal bracing of 2 inch by 2 inch by 1/4-inch minimum, aluminum angles shall be applied to all panels at 4 feet centers.
   e. Casing gaskets shall be as specified in Section 2.2, and shall be black in color.
2. Insulated Casings

a. Where insulated casings are called for, the Contractor shall install 2-inch thick insulated sandwich construction panels for the entire casing.

b. Where galvanized and stainless steel casings are used, the inner and outer sheets shall be no less than 0.040 of an inch thick. Where aluminum casings are used, the inner and outer sheets shall be 0.050 of an inch thick (3003-H14). In either case, the Contractor shall obtain written final approval of panel design from the Buyer before proceeding with fabrication.

c. Horizontal bracing of the casings shall be accomplished by use of angles of the same type material as the casing, and shall be of a quality and type approved by the Buyer. Angles shall be 2 inch by 2 inch by 1/4-inch minimum, aluminum angles on 4 feet centers.

d. Any ductwork required from the outside air intake louver to the casing shall be insulated in a manner similar to the casings.

e. Insulation shall be rigid fiberglass board, Type 705, as manufactured by Owens Corning, or an approved equal. A substitute for this may be spray foam. Insulation shall be secured using both stick pins on 18 inch maximum center to center and an adhesive as recommended by the insulation manufacturer.

F. Access Doors

1. Access doors or removable panels shall be provided in ducts, casings, and plenums as indicated or required for inspection, cleaning and repair of filters, turning vanes, fans, duct heaters, controls dampers, and splitters.

2. Straight runs of ductwork shall have access doors every 50 feet unless otherwise specified. Registers or grilles may be used as access ways providing that adequate access is available when these are removed.

3. Casings and ductwork shall be sufficiently braced and supported so that they do not vibrate or become distorted.
where access doors are installed.

G. Ductwork Erection

1. All acceptable, regionally known, or used duct construction methods are not shown in this section of specifications. Those that are shown are acceptable unless specified or indicated otherwise.

2. The Contractor responsible for fabrication and erection of this portion of the work is urged to have copies of all SMACNA manuals for detailed references to construction.

3. If the Contractor wishes to use construction techniques or materials other than those specified, he shall first obtain the written approval of the Buyer before proceeding with fabrication, construction, and erection. Unapproved construction is subject to removal and subsequent replacement with approved construction.

4. Transverse Reinforcing

   a. When transverse reinforcing is required, it shall be provided on all 4 sides and tied together at each corner by welding for stainless steel and aluminum reinforcing, and by bolting for galvanized reinforcing. Reinforcing on only 2 sides is not acceptable.

   b. Transverse reinforcing requirements shall be determined by the duct side dimensions. Angle sizes are based on mild steel. Reinforcing made in other shapes or other materials shall be of equivalent strength and rigidity.

   c. The longitudinal spacing of the transverse reinforcing between joints may necessarily be less than the spacings recommended in the charts in order to conform to the selected length of modules.

5. When more than 2 tie rods are required, rods shall be equally spaced across the duct.

6. Welding of all aluminum and stainless steel reinforcing angles shall be 1 inch by 6 inch stitch weld, alternating on both sides. Galveston reinforced angle shall be bolted on 6 inch centers.

H. Sheet Metal Gage and Construction

1. Rectangular Ductwork
a. Where the distance between joints is the same or less than the reinforcing spacing, extra reinforcing may be omitted.

b. Seams for joining panels shall be inside standing seams running in the same direction as the flow of air within the ducts. Duct panel widths shall not exceed 3'-9".

c. Duct construction other than that specified will be considered for approval if details are submitted to the buyer prior to construction.

d. Casing panels are to be constructed using same gages as ducts over 96 inches.

2. Round Ductwork

a. Where the distance between joints is the same or less than the reinforcing spacing, the extra reinforcing may be omitted.

b. Duct construction other than that specified will be considered for approval if details are submitted to the Buyer prior to construction.

I. Manual-Volume Dampers

1. Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

J. Motorized Dampers

1. Dampers: AMCA-rated, parallel or opposed blade design; form frames from not less than 0.1084-inch galvanized steel with mounting holes for duct mounting; damper blades not less than 0.0635-inch galvanized steel, with maximum blade width of 8 inches.

2. Blades secured to 1/2-inch diameter, zinc-plated axles using zinc-plated hardware, with nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass. Ends sealed against spring-stainless-steel blade bearings. Thrust bearings at each end of every blade.

3. Operating Temperature Range: From -40 to 200 deg F.
4. For standard applications as indicated, (as selected by manufacturer's sizing techniques) with optional closed-cell neoprene edging.

5. For low-leakage applications as indicated, provide parallel or opposed blade design (as selected by manufacturer's sizing techniques) with inflatable seal blade edging, or replaceable rubber seals, rated for leakage at less than 10 cfm/sq. ft. of damper area, at differential pressure of 4 inches wg when damper is being held by torque of 50 inch-pounds; test in accordance with AMCA 500.

K. Actuators

1. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or 2-position action.
   a. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
   c. Spring-Return Motors for Valves Larger Than 2-1/2 Inches: Size for running and breakaway torque of 150 inch-pounds.
   d. Nonspring-Return Motors for Dampers Larger Than 25 sq. ft.: Size for running torque of 150 inch-pounds and breakaway torque of 300 inch-pounds.
   e. Spring-Return Motors for Dampers Larger Than 25 sq. ft.: Size for running and breakaway torque of 150 inch-pounds.

PART 3 EXECUTION

3.01 INSPECTION AND TESTS

A. The total allowable air leakage for the completed installation shall not exceed 5 percent of the total system capacity when tested in accordance with the HVAC Air Duct Leakage Test Manual as published by SMACNA.
B. If the installed system fails the air leakage test, the Contractor shall repair the ductwork to meet the 5 percent maximum air leakage requirement. Duct tape shall not be used to meet air leakage requirements.

END OF SECTION
SECTION 15830
FANS

PART 1 GENERAL
1.01 DESCRIPTION
A. This Section includes the following:
   1. Centrifugal roof ventilators.

1.02 PERFORMANCE REQUIREMENTS
A. Operating Limits: Classify according to AMCA 99

1.03 SUBMITTALS
A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
   1. Certified fan performance curves with system operating conditions indicated.
   2. Certified fan sound-power ratings.
   3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   4. Material gages and finishes, including color charts.
   5. Dampers, including housings, linkages, and operators.
B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
C. Operation and Maintenance Data: For power ventilators to include in operation and maintenance manuals specified in Division 1.
1.04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.

D. UL Standard: Power ventilators shall comply with UL 705.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.

1.06 COORDINATION

A. Coordinate size and location of structural-steel support member.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Centrifugal Roof Ventilators:
   a. Cook, Loren Company.
   b. Greenheck Fan Corp.
   c. Penn Ventilation Companies, Inc.

2.02 CENTRIFUGAL ROOF VENTILATORS

A. Description: direct-drive centrifugal fans, as indicated, consisting of housing, wheel, fan shaft, bearings, motor and disconnect switch, drive assembly, curb base, and accessories.
B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Accessories: The following items are required as indicated:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 percent to less than 50 percent.

2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

3. Bird Screens: Removable 1/2-inch mesh, aluminum or brass wire.

4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

5. Roof Curbs: Galvanized steel; mitered and welded corners; 2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 2-inch wood nailer. Size as required to suit roof opening and fan base.

   a. Configuration: Self-flashing without a cant strip, with mounting flange.

2.03 MOTORS

A. Enclosure Type: Guarded dripproof.

2.04 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings
according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

PART 3 EXECUTION

3.01 INSTALLATION

A. Install power ventilators level and plumb.

B. Support units using spring isolators having a static deflection of 1 inch.
   1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Division 15 Section "Mechanical Identification."

3.02 CONNECTIONS

A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

A. Equipment Startup Checks:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Verify lubrication for bearings and other moving parts.

6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

7. Disable automatic temperature-control operators.

B. Starting Procedures:

1. Energize motor and adjust fan to indicated rpm.

2. Measure and record motor voltage and amperage.

C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.

D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Shut unit down and reconnect automatic temperature-control operators.

F. Refer to Division 15 Section "Testing, Adjusting and Balancing" for testing, adjusting and balancing procedures.

G. Replace fan and motor pulleys as required to achieve design airflow.

H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.
3.05 CLEANING

A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

2. Review data in operation and maintenance manuals. Refer to Division 1 Section "Closeout Procedures."

3. Review data in operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION
SECTION 15835

TERMINAL HEAT TRANSFER UNIT

PART 1   GENERAL

1.01  GENERAL

A. Submittals: Submit product data according to the Conditions of the Contract and Division 1 Specification Sections.

B. Comply with NFPA 70 for components and installation.

C. Listing and Labeling: Provide products specified in this Section that are listed and labeled as defined in the National Electrical Code, Article 100.

PART 2   PRODUCTS

2.01  UNIT HEATERS

A. Unit Heaters: Propeller-type, horizontal discharge heating units, with heating coils, fans, motors, and self-contained controls.

1. Casing: Steel or aluminum with removable access panels to remove, service, and maintain major components.

2. Electric Heating Elements: Nickel-chromium heating wire element; free from expansion noise and 60-Hz hum; embedded in magnesium oxide, insulating refractory; and sealed in high-mass steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends are enclosed in terminal box. Fin surface temperature does not exceed 550 °F at any point during normal operation.

   a. Electric Heater Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for over temperature protection of heaters.

3. Fan and Motor: Direct-drive propeller fan and manufacturer's standard motor. Motors sized 1 hp and less include motor overload protection.

4. Wiring Terminations: Match conductor materials and sizes indicated.
5. Discharge Configuration: Horizontal discharge with horizontal, adjustable louvers.

6. Optional Accessories: Include the following:
   a. Wall thermostat.
   b. Safety-switch disconnect on cover of terminal box.

7. Acceptable Manufacturers: Subject to compliance with requirements, furnish and install Unit Heater of one of the following or approved equal:
   a. Indeeco
   b. Qmark
   c. Chromalox
   d. Or equal

2.02 BASEBOARD HEATER

A. Material and Equipment:
   1. General: Furnish and install electric baseboard heater, review Contract drawings for quantities, manufacturer’s standard materials and components as indicated by published product information, UL listed, designed and constructed as recommended by the manufacturer, and as required for a complete installation.

B. Heating Elements:
   1. General: Except as otherwise indicated, provide manufacturer’s standard elements of the indicated duty and rated for the indicated capacity. 80/20 NiCh resistance wire, enclosed in a steel sheath. Aluminum fins shall be so designed as to block sheath radiation to front and back of heater body and pressure bond to steel sheath.

C. Enclosure:
   1. General: Front Cover and Brackets shall be made of heavy 1 8-gauge Galvanized steel. Junction box enclosure to have provisions for incoming and outgoing cable.
D. Construction:

1. Liner thermal cut-out shall be factory installed to automatically shut off heater in the event of over heating and reactive heater when temperatures return to normal.

2. Each heater is equipped with a factory installed integral thermostat having an adjustment range of 40 °F to 100 °F.

3. Housing: Galvanized steel.

4. Acceptable Manufacturer: Subject to compliance with requirements, furnish and install Baseboard Heaters one of the following or approved equal:

   a. Qmark, Baseboard Heater, QMKC Series
   b. Chromalox
   c. Markel
   d. Or equal

PART 3 EXECUTION

3.01 INSTALLATION

A. Install unit heaters as indicated, according to manufacturer's written instructions and NFPA 90A.

B. Connect unit heaters and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.

END OF SECTION
SECTION 15850
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 DESCRIPTION
A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.

B. Types of outlets and inlets required for project include the following:
   1. Wall registers and grilles.
   2. Louvers.

C. Refer to other Division 15 sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.

D. Refer to other Division 15 sections for balancing of air outlets and inlets; not work of this section.

1.02 QUALITY ASSURANCE
A. Codes and Standards
   1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
   2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
   3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
   4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
   5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
   6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems."

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:

1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.

2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.

3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 PRODUCTS

2.01 WALL REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device and listed in manufacturer’s current data.

C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule in drawings.

E. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one of the following:

1. METALAIRE, Inc.
2. Tuttle & Bailey; Div. of Interpace Corp.
3. Titus
4. Or approved equal.

2.02 Ceiling Air Diffusers:

A. General: Except as otherwise indicated, provide manufacturer’s standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer’s current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule
F. Manufacturer: Subject to compliance with requirements, provide
registers and grilles of one of the following:

1. METALAIRE, Inc.
2. Tuttle & Bailey; Div. of Interpace Corp.
3. Titus
4. Or approved equal.

2.02 LOUVERS

A. General: Except as otherwise indicated, provide manufacturer's
standard louvers where shown; of size, shape, capacity and type
indicated; constructed of materials and components as indicated, and as
required for complete installation.

B. Performance: Provide louvers that have minimum free area, and
maximum pressure drop of each type as listed in manufacturer's current
data, complying with louver schedule.

C. Substrate Compatibility: Provide louvers with frame and sill styles that
are compatible with adjacent substrate, and that are specifically
manufactured to fit into construction openings with accurate fit and
adequate support, for weatherproof installation. Refer to general
construction drawings and specifications for types of substrate which
will contain each type of louver.

D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-
T52. Weld units or use stainless steel fasteners.

E. Louver Screens: On inside face of exterior louvers, provide 1/2" square
mesh anodized aluminum wire bird screens mounted in removable
extruded aluminum frames.

F. Available Manufacturers: Subject to compliance with requirements,
manufacturers offering louvers which may be incorporated in the work
include, but are not limited to, the following:

G. Manufacturer: Subject to compliance with requirements, provide louvers
of one of the following:

2. Industrial Louvers, Inc.
3. Penn Ventilator Co., Inc.
PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended function.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans." Unless otherwise indicated, locate units in center of acoustical ceiling module.

3.03 SPARE PARTS

A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION
SECTION 15950
TESTING, ADJUSTING AND BALANCING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section includes the following:

1. Instructions for testing, adjusting, and balancing of Division 15 specified equipment.

B. Employment of a Testing, Adjusting and Balancing (TAB) organization:

C. Engage a qualified organization to perform the specified testing, adjusting and balancing (TAB) services; pay all costs for services.

1. Organization shall be completely independent of all Division 15 Contractors and Subcontractors.

2. Employment of the organization shall in no way relieve Contractor's obligation to perform Work of the Contract.

D. Terminology

1. The abbreviation TAB is used in this section for the words "testing, adjusting and balancing".

2. The organization performing the TAB services described in this section will be referred to as "Balancing Contractor".

3. The words "Installing Contractor" used in this section refer to the Contractor(s) or Subcontractor(s) responsible for the furnishing and installation of the work specified in Division 15.

E. Project TAB Requirements

1. Perform testing, adjusting and balancing of new and altered air distribution system(s), air moving equipment and terminal devices, including:

   a. Adjust and set all dampers, deflecting vanes, discharge vanes and accessories to achieve proper air distribution and patterns in all parts of the systems.

   b. Adjust and set belt driven fans to achieve design or
optimum total delivered quantities.


2. Perform testing, adjusting and balancing of new and altered hydronic systems, adjust and set balancing valves and other flow devices to achieve proper water distribution in all parts of the circulated water systems, measure and record liquid flow at each piece of equipment, measure and record motor and pump performance. Prepare and submit water-balancing report.

3. Inspect the function and operation of all temperature control devices associated with the equipment and systems being tested, adjusted and balanced.

4. Prepare and submit reports and other data as specified.

5. Provide all instruments required for work.
   a. Make instruments available to SEPTA PM to facilitate spot checks during testing.
   b. Retain possession of instruments and remove from site at completion of services.

1.02 RELATED WORK

A. Section 01100: Alternates.

B. Section 01700: Contract Closeout.

1.03 REFERENCE STANDARDS

A. AABC - All applicable standards and procedures of the Associated Air Balance Council.

B. All applicable standards and procedures of the National Environmental Balancing Bureau (NEBB).

1.04 SUBMITTALS

A. Submit written reports for review upon completion of each major phase of a TAB work.

B. Submit reports of delayed TAB work promptly after execution of those services.
C. **Form of Final Reports**

1. Each final reporting form must bear the signature of the person who recorded data and seal and signature of the TAB supervisor of the reporting organization.

2. When more than one certified organization performs TAB services, the firm having managerial responsibility shall make the submittals.

3. Identify instruments of all types which were used, and last date of calibration of each.

4. Submit final TAB Report in accordance with requirements specified herein, modified and expanded to be compatible with the requirements of the installed systems.

### 1.05 WARRANTY AND CONTRACT CLOSEOUT

**A. Warranty**

1. Provide a National Certification Guarantee from the AABC or NEBB, applicable for the TAB work performed under this contract.

2. After completion of the work specified under this Section 15990, provide an extended warranty encompassing one full heating season and one full ventilating season during which time any balancing device which had been adjusted earlier as part of this work is deemed necessary by the Owner or the SEPTA PM.

**B. Contract Closeout**

1. Submit reports for:

   a. Air distribution systems balancing.
   
   b. Water systems balancing.
   

2. Submit National Certification Guarantee from AABC or NEBB.

### 1.06 QUALITY ASSURANCE

**A.** The organization, which performs the TAB service, shall be current member in good standing, certified to perform services required for the project, of either:
1. Associated Air Balance Council (AABC).

2. National Environmental Balancing Bureau (NEBB).

B. The TAB Work performed by Balancing Contractor shall be under the direct supervision of a Registered Professional Engineer, a full time employee of Balancing Contractor. Technicians performing the work must be properly trained, experienced and full-time employees of Balancing Contractor.

C. Within 30 days after award of contract, transmit to SEPTA PM the name of organization proposed to perform the TAB services.

1. Submit proof of having balanced and tested at least five projects of similar size and scope.

2. Should separate firms perform services for air and hydronic portions, certify the firm which has managerial responsibilities for coordination of entire testing and balancing process.

D. Comply with applicable procedures and standards of the certification sponsoring association unless more stringent requirements are specified in this section; either:

1. Current issue of "National Standards for Total System Balance", by AABC.

2. Current issue of "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems", dated by NEBB.

3. Calibration and maintenance of instruments shall be in accord with requirements of the standards. Instruments used in the performance of the TAB Work must have been calibrated within six months preceding the date of usage. Calibration histories for each instrument shall be included with the TAB report.

4. Accuracy of measurements shall comply with the more stringent of the requirements of the standards or the tolerances specified hereinafter.

E. Balancing Tolerances

1. Air Systems: Balance all equipment, air outlets and air intakes in accordance with the air quantities shown on the drawings with permissible tolerances as follows:

   a. Supply and exhaust fan
      1) Fan serving multiple rooms -5% to +10%
      2) Fan serving individual hood ±5%
b. Minimum outside air -0% to +5%
c. Supply, return, exhaust, transfer to individual rooms -5% to +10%
   1) Other -5% to +10%
d. Individual outlet or intake or transfer for rooms with multiple outlets, intakes or transfer ±10%

2. Hydronic Systems: Balance all equipment in accordance with the capacities and flow quantities shown on the drawings with a permissible tolerance of -5% to +10%.

F. If during progress of the construction or during balancing, the Balancing Contractor encounters any condition that will not allow balancing to be performed within the above balancing tolerances, the fact(s) shall be reported immediately to the SEPTA PM with recommendations for corrective actions. If feasible, report such conditions and recommendations prior to submission of balancing reports. Work shall then proceed in accordance with the response provided by the SEPTA PM.

1.07  COORDINATION AND COOPERATION

A. Installing Contractor responsible for Work under Division 15 will provide services outlined in Section 15050, BASIC MATERIALS AND METHODS.

B. Enlist the aid of Installing Contractor or equipment suppliers, at no cost to Owner, whenever such aid is necessary for the timely and proper performance of the TAB work.

C. Cooperate with Installing Contractor to effect smooth coordination of the TAB work with the project schedule.

1.08  PROCEDURES

A. Report and review the requirements of the TAB work with SEPTA PM before starting any field TAB work.

B. Periodically visit the site, a maximum of one-month intervals, during installation of the work. Should any potential or developing problems be discovered relating to materials, equipment or methods being used in the work, anywhere such problems any adversely affect the TAB work, immediately report these findings in writing to the SEPTA PM with recommendations for correction.
PART 2   PRODUCTS – NOT USED

END OF SECTION
SECTION 16010
ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

A. Comply with all Contract requirements and Division 1 Sections applying to or affecting the Work of Division 16.

B. Unless specifically dimensioned, the Work shown on the drawings is diagrammatic only to show general arrangement.

C. The work in accordance with drawings and specifications shall consist of furnishing all equipment, materials, labor, services and performing all operations for complete installation of electrical work.

D. Any equipment, materials, labor or services not specifically mentioned herein which may be necessary to complete or perfect any part of installation in a substantial manner shall be furnished with no extra cost to the Owner.

1.02 RELATED SECTIONS

A. Section 07270 – Firestopping.

B. Section 16050 – Basic Electrical Materials and Methods.

C. Section 16060 – Grounding and Bonding.

D. Section 16070 – Hangers and Supports.

E. Section 16075 – Electrical Identification.

F. Section 16120 – Conductors and Cables.

G. Section 16130 - Raceways and Boxes.

H. Section 16140 - Wiring Devices.

I. Section 16150 - Wiring Connections.

J. Section 16400 - Low-Voltage Distribution

K. Section 16410 - Enclosed Switches and Circuit Breakers.

L. Section 16442 - Panelboards.
M. Section 16510 - Interior Luminaires.
N. Section 16525 - Site Lighting
O. Section 16730 - AVPA for Heavy Rail
P. Section 16970 - Testing and Commissioning.

1.03 SUBMITTALS

A. Submit catalogue cuts, specifications, capacities, electrical characteristics, installation instructions and dimension drawings for each type of equipment specified and operating maintenance manuals for record.

B. Submit shop drawings for review in accordance with the requirements of this section and other sections of the technical specification.

C. In order to facilitate the review of submittals, identify the proposed products with the identical markings, symbols and nomenclature used in the contract documents.

D. Submit complete set of as-built drawings after completion of work.

1.04 CUTTING AND PATCHING

A. Provide cutting and patching as required for the completion of the electrical work.

1.05 STORAGE, AND HANDLING

A. Where possible, store materials and equipment inside to protect from weather. Where necessary to store outside, elevate above grade and enclose with durance waterproof wrapping.

1.06 COMPLIANCE WITH CODES, STANDARDS AND REGULATIONS

A. In absence of specific instructions in technical specifications, electrical equipment and their installation shall conform to the following applicable codes, standards and regulations, latest editions:


2. Occupational Safety and Health Administration (OSHA).
3. Underwriter’s Laboratories, Inc. (UL).

END OF SECTION
SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes the following:
   1. Electrical equipment coordination and installation.
   2. Sleeves for raceways and cables.
   3. Sleeve seals.
   4. Common electrical installation requirements.

1.02 RELATED SECTIONS

A. Section 07270 – Firestopping.
B. Section 16010 – Electrical Requirements.
C. Section 16060 – Grounding and Bonding.
D. Section 16070 – Hangers and Supports
E. Section 16075 – Electrical Identification
F. Section 16120 – Conductors and Cables.
G. Section 16130 – Raceways and Boxes.
H. Section 16140 – Wiring Devices.
I. Section 16150 – Wiring Connections
J. Section 16400 – Low-Voltage Distribution
K. Section 16410 – Enclosed Switches and Circuit Breakers
L. Section 16442 – Panelboards
M. Section 16510 – Interior Luminaires
N. Section 16525 – Site Lighting
O. Section 16530 – Emergency Lighting
P. Section 16730 – AVPA Systems for Heavy Rail
Q. Section 16880 – Electric Resistance Heating
R. Section 16970 – Testing and Commissioning

1.03 SUBMITTALS
A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical components used.
   1. Annotate to indicate application of each product submitted and compliance with requirements.

1.04 QUALITY ASSURANCE
A. Perform work in accordance with the Township of Levittown Standards.
B. Test Equipment Suitability and Calibration: Comply with NETA ATS, “Suitability of Test Equipment” and “Test Instrument Calibration.”

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Protect from construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 SLEEVES FOR RACEWAYS AND CABLES
A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
2.03 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.

2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to raceways and piping systems installed at a required slope.
3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, penetrate concrete slabs, concrete or masonry walls.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.

2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

E. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.

3.03 SLEEVE-SEAL INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIELD QUALITY CONTROL

A. Inspect installed sleeve and sleeve-seal for damage and faulty work.

END OF SECTION
SECTION 16060
GROUNDING AND BONDING

PART 1  GENERAL

1.01  DESCRIPTION
A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.02  RELATED SECTIONS
A. Section 16010 – Electrical Requirements.
B. Section 16050 – Basic Electrical Materials and Methods.
C. Section 16120 – Conductors and Cables.
D. Section 16130 – Raceways and Boxes.
E. Section 16140 – Wiring Devices.
F. Section 16150 – Wiring Connections
G. Section 16400 – Low Voltage Distribution
H. Section 16410 – Enclosed Switches and Circuit Breakers.
I. Section 16442 – Panelboards.
J. Section 16510 – Interior Luminaires.
K. Section 16525 – Site Lighting
L. Section 16530 – Emergency Lighting
M. Section 16730 – AVPA Systems for Heavy Rail
N. Section 16880 – Electric Resistance Heating

1.03  SUBMITTALS
A. Product Data: For each type of product indicated.
1.04 QUALITY ASSURANCE

A. Perform work in accordance with the Township of Levittown Standards.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Grounding Conductors, Cables, Connectors, and Rods:
   a. Copperweld Corp.
   c. Raco, Inc.; Division of Hubbell.
   d. Thomas & Betts, Electrical.

2.02 ROD ELECTRODE

A. Material: Copper

B. Diameter: ¾ inch.

C. Length: 10 feet

2.03 GROUNDING CONDUCTORS

A. Equipment Grounding Conductors: Insulated with green-colored insulation.

B. Grounding Electrode Conductors: Stranded cable.

C. Bare Copper Conductors: Comply with the following:


D. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.

2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.

3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.04 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer’s written instructions.

PART 3 EXECUTION

3.01 APPLICATION

A. In raceways, use insulated equipment grounding conductors.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

C. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.02 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install equipment grounding conductors in all feeders and circuits.
C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

E. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

3.03 INSTALLATION

A. Install rod electrodes at locations indicated. Install additional rod electrodes as required to achieve specified resistance to ground.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any
adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building’s main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

3.04 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.


5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer’s written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding
conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.05 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.


3. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner’s Representative promptly and include recommendations to reduce ground resistance.

END OF SECTION
SECTION 16070
HANGERS AND SUPPORTS

PART 1   GENERAL

1.01   DESCRIPTION

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.

1.02   RELATED SECTIONS

A. Section 16010 – Electrical Requirements.
B. Section 16050 – Basic Electrical Materials and Methods.
C. Section 16060 - Grounding and Bonding
D. Section 16130 – Raceways and Boxes.
E. Section 16400 – Low-Voltage Distribution
F. Section 16410 – Enclosed Switches and Circuit Breakers.
G. Section 16442 – Panelboards.
H. Section 16510 – Interior Luminaires.
I. Section 16530 – Emergency Lighting
J. Section 16730 – AVPA Systems for Heavy Rail
K. Section 16880 – Electric Resistance Heating

1.03   SUBMITTALS

A. Product Data: Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of electrical support component used.

1. Annotate to indicate application of each product submitted and compliance with requirements.
1.04 QUALITY ASSURANCE

A. Perform work in accordance with the Township of Levittown Standards.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Protect from construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Manufacturers:
   a. Linport International, Inc.
   b. Cooper B-Line; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. Allied Support Systems; Power-Strut Unit.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Finishes:

1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.

B. Channel Dimensions: Selected for structural loading forces.
C. Raceway and Cable Supports: As described in NECA 1.

D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers:
      1) Cooper B-Line; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti, Inc.
      4) ITW Construction Products.
      5) MKT Fastening, LLC.
      6) Powers Fasteners.

2. Concrete Inserts: Galvanized Steel.

3. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.


5. Toggle Bolts: All-steel springhead type.

2.03 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

PART 3 EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

D. Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

E. Secure raceways and cables to these supports with single-bolt conduit clamps.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.02 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05500 – Metal Fabrications for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.
3.03 FIELD QUALITY CONTROL

A. Testing: Test pullout resistance of anchorage devices.

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days’ advance notice.

3. Obtain Owner’s approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test to 90 percent of rated proof load of device.

5. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

B. Record test results.

END OF SECTION
SECTION 16075
ELECTRICAL IDENTIFICATION

PART 1    GENERAL

1.01 DESCRIPTION

A. This Section includes the following:
   1. Identification for raceway and metal-clad cable.
   2. Warning labels and signs.
   3. Instruction signs.
   4. Equipment identification labels.
   5. Miscellaneous identification products.

1.02 RELATED DOCUMENTS

A. Section 16010 – Electrical Requirements.
B. Section 16050 – Basic Electrical Materials and Methods.
C. Section 16070 – Hangers and Supports.
D. Section 16120 – Conductors and Cables.
E. Section 16130 – Raceways and Boxes.
F. Section 16140 – Wiring Devices.
G. Section 16410 – Enclosed Switches and Circuit Breakers.
H. Section 16442 – Panelboards.
I. Section 16510 – Interior Luminaires
J. Section 16525 – Site Lighting
K. Section 16730 – AVPA Systems for Heavy Rail.
L. Section 16880 – Electric Resistance Heating.

1.03 SUBMITTALS

A. Product Data: For each electrical identification product indicated.
B. Samples: Submit two tags, labels, conduit markers, size used on project.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Comply with NFPA 70.


C. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

PART 2 PRODUCTS

2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Color for Printed Legend:
   1. Power Circuits: Black letters on an orange field.
   2. Legend: Indicate system or service and voltage, if applicable.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
E. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

2.02 WARNING LABELS AND SIGNS


B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.

C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.

D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

2.03 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.

2. Punched or drilled for mechanical fasteners.

3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
2.04 EQUIPMENT IDENTIFICATION LABELS


2.05 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
   2. Tensile Strength: 50 lb, minimum.
   3. Temperature Range: Minus 40 to plus 185 deg F.

B. Paint: Paint materials and application requirements are specified in Division 9 painting Sections.
   1. Interior Ferrous Metal:
      a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.
         1) Primer: Interior ferrous-metal primer.
         2) Finish Coats: Interior semigloss acrylic enamel.
   2. Interior Zinc-Coated Metal (except Raceways):
      a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.
         1) Primer: Interior zinc-coated metal primer.
         2) Finish Coats: Interior semigloss acrylic enamel.

C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 EXECUTION

3.01 APPLICATION

A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange snap-around label.
B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:

1. Mechanical and Electrical Supervisory System: Green and blue.
2. Control Wiring: Green and red.

C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes use color-coding conductor tape write-on tags. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.

D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.


1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

F. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.

1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
   a. Power transfer switches.
   b. Controls with external control power connections.
2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

G. Instruction Signs:

1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.

H. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

1. Labeling Instructions:
   a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where 2 lines of text are required, use labels 2 inches high.
   b. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to Be Labeled:
   a. Panelboards, electrical cabinets, and enclosures.
   b. Disconnect switches.
   c. Enclosed circuit breakers.
   d. Motor starters.
   e. Push-button stations.

3.02 INSTALLATION

A. Verify identity of each item before installing identification products.
B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

F. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.

1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.

2. Colors for 208/120-V Circuits:
   a. Phase A: Black.
   b. Phase B: Red.
   c. Phase C: Blue.

3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

G. Painted Identification: Prepare surface and apply paint according to Division 9 painting Sections.
H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

END OF SECTION
SECTION 16120
CONDUCTORS AND CABLES

PART 1  GENERAL

1.01  DESCRIPTION
A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.02  RELATED DOCUMENTS
A. Section 16010 – Electrical Requirements
B. Section 16050 – Basic Electrical Materials and Methods
C. Section 16060 – Grounding and Bonding
D. Section 16070 – Hangers and Supports
E. Section 16075 – Electrical Identification
F. Section 16130 – Raceways and Boxes
G. Section 16140 – Wiring Devices
H. Section 16150 – Wiring Connections
I. Section 16400 – Low-Voltage Distribution
J. Section 16410 – Enclosed Switches and Circuit Breakers
K. Section 16442 – Panelboards
L. Section 16510 – Interior Luminaires
M. Section 16525 – Site Lighting
N. Section 16530 – Emergency Lighting
O. Section 16730 – AVPA Systems for Heavy Rail
P. Section 16880 – Electric Resistance Heating
1.03 SUBMITTALS
A. Product Data: For each type of product indicated.

1.04 QUALITY ASSURANCE
A. Comply with NFPA 70.
B. Perform work in accordance with the Township of Levittown Standards.

1.05 DELIVERY, STORAGE AND HANDLING
A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Protect from construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
   1. The Okonite Company.
   3. General Cable Corporation.
   4. Senator Wire & Cable Company.
   5. Southwire Company.

2.02 CONDUCTORS AND CABLES
A. Conductor Material: Copper complying with NEMA WC 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.
B. Conductor Insulation Types: Type THHN-THWN and SO complying with NEMA WC 7.
C. High-voltage 15 KV single-conductor, shielded cables shall be insulated with a heat-, moisture-, ozone- and corona-resistant cross-linked polyethylene compound. Conductors shall be soft copper wire Class "B" stranded meeting ASTM B8. Cable shall
meet or exceed the latest editions of ICEA S-66-524, AEIC CS-5 and UL 1072. Cables shall be insulated at the 133 percent level. The strand screen, insulation, and insulation screen shall be applied with the triple-extrusion process. Cable core shall be shielded with non-magnetic soft-drawn uncoated copper wires helically applied over the insulation shield. Cable jacket shall be a chlorosulfonated polyethylene (CSPE) complying with ICEA S-66-524 and UL 1072.

D. Multiconductor Cable:
   1. Armored Cable, Type AC, and Type SO with ground wire.
   2. Galvanized Steel Interlocked Armor Cable, Type MC with PVX jacket.

2.03 CONNECTORS AND SPLICES

A. Manufacturers:
   1. AFC Cable Systems, Inc.
   2. AMP Incorporated/Tyco International.
   3. Hubbell/Anderson.
   4. O-Z/Gedney; EGS Electrical Group LLC.
   5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 EXECUTION

3.01 CONDUCTOR AND INSULATION APPLICATIONS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.

B. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway, Armored cable, Type AC, Metal-clad cable, Type MC.

C. Branch Circuits Concealed in Wall or Ceiling: Type THHN-THWN, single conductors in raceway, Metal-clad cable, Type MC.
D. Branch Circuits Concealed in Concrete: Type THHN-THWN, single conductors in raceway.

E. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.

3.02 INSTALLATION

A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

B. Use pulling means; including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.03 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

   1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.04 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

   1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

   2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
3. Each reel of completed high voltage cable shall be subjected to a partial discharge extinction level test performed in accordance with the test procedures described in Section G of AEIC CS-5, and standard factory tests as described in ICEA S-66-524 shall be performed on completed cables and a certificate of compliance shall be submitted to the Owner upon shipment.

B. Test Reports: Prepare a written report to record the following:

1. Test procedures used.

2. Test results that comply with requirements.

END OF SECTION
SECTION 16130

RACEWAYS AND BOXES

PART 1  GENERAL

1.01  DESCRIPTION

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.02  RELATED SECTIONS

A. Section 16010 – Electrical Requirements
B. Section 16050 – Basic Electrical Materials and Methods
C. Section 16060 – Grounding and Bonding
D. Section 16070 – Hangers and Supports
E. Section 16075 – Electrical Identification
F. Section 16120 – Conductors and Cables
G. Section 16140 – Wiring Devices
H. Section 16150 – Wiring Connections
I. Section 16400 – Low-Voltage Distribution
J. Section 16410 – Enclosed Switches and Circuit Breakers
K. Section 16442 - Panelboards
L. Section 16510 – Interior Luminaires
M. Section 16525 – Site Lighting
N. Section 16530 – Emergency Lighting
O. Section 16730 – AVPA Systems for Heavy Rail
P. Section 16880 – Electrical Resistance Heating
1.03 SUBMITTALS
A. Product Data: For surface raceways, wireways and fittings, junction and pull boxes, hinged-cover enclosures, and cabinets.

1.04 QUALITY ASSURANCE
A. Perform work in accordance with the Township of Levittown Standards.
B. Comply with NFPA 70.

1.05 DELIVERY, STORAGE AND HANDLING
A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Protect from construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 PRODUCTS
2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 METAL CONDUIT AND TUBING
A. Manufacturers:
   1. AFC Cable Systems, Inc.
   2. Alflex Inc.
   3. Anamet Electrical, Inc.; Anaconda Metal Hose.
   4. Grinnell Co./Tyco International; Allied Tube and Conduit Div.
   5. O-Z Gedney; Unit of General Signal.
   6. Wheatland Tube Co.
B. Rigid Steel Conduit: ANSI C80.1.
D. FMC: Zinc-coated steel.
E. LFMC: Flexible steel conduit with PVC jacket.
F. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.03 METAL WIREWAYS

A. Manufacturers:
   1. Hoffman.
   2. Square D.
   3. Steel City.

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 3R.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Flanged-and-gasketed type.

F. Finish: Manufacturer’s standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:
   1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
   2. Emerson/General Signal; Appleton Electric Company.
   3. Hoffman.
   5. O-Z/Gedney; Unit of General Signal.
   6. RACO; Division of Hubbell, Inc.
   7. Robroy Industries, Inc.; Enclosure Division.
   8. Thomas & Betts Corporation.
B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.

F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

G. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.05 FACTORY FINISHES

A. Finish: For raceway, enclosure, or cabinet components, provide manufacturer's standard prime-coat finish ready for field painting.

PART 3 EXECUTION

3.01 RACEWAY APPLICATION

A. Indoors:
   1. Exposed: RSC.
   2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except use LFMC in damp or wet locations.
   3. Damp or Wet Locations: Rigid steel conduit.
4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:

5. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

B. Minimum Raceway Size: 3/4-inch trade size.

C. Raceway Fittings: Compatible with raceways and suitable for use and location.

   1. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

3.02 INSTALLATION

A. Install horizontal raceway runs above water piping.

B. Complete raceway installation before starting conductor installation.

C. Install temporary closures to prevent foreign matter from entering raceways.

D. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab.

E. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated.

F. Install exposed raceways parallel or at right angles to nearby surfaces or structural members and follow surface contours as much as possible.

   1. Run parallel or banked raceways together on common supports.

   2. Make parallel bends in parallel or banked runs. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

G. Join raceways with fittings designed and approved for that purpose and make joints tight.

   1. Use insulating bushings to protect conductors.

H. Tighten set screws of threadless fittings with suitable tools.
I. Terminations:

1. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

2. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

K. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

   1. Where otherwise required by NFPA 70.

L. Flexible Connections: Use maximum of 72 inches of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

M. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

N. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.03 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.
3.04 CLEANING

A. Section 01710 – Final Cleaning.

B. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION
SECTION 16140

WIRING DEVICES

PART 1  GENERAL

1.01  DESCRIPTION

A. This Section includes the following:
   1. Single and duplex receptacles, ground-fault circuit interrupters, integral surge suppression units, and isolated-ground receptacles.
   3. Device wall plates.

1.02 RELATED DOCUMENTS

A. Section 16010 – Electrical Requirements
B. Section 16050 – Basic Electrical Materials and Methods
C. Section 16060 – Grounding and Bonding
D. Section 16070 – Hangers and Supports
E. Section 16075 – Electrical Identification
F. Section 16120 – Conductors and Cables
G. Section 16130 – Raceways and Boxes
H. Section 16150 – Wiring Connections
I. Section 16400 – Low-Voltage Distribution
J. Section 16410 – Enclosed Switches and Circuit Breakers
K. Section 16442 - Panelboards
L. Section 16510 – Interior Luminaires
M. Section 16525 – Site Lighting
N. Section 16530 – Emergency Lighting
O. Section 16730 – AVPA Systems for Heavy Rail  
P. Section 16880 – Electrical Resistance Heating  
Q. Section 16970 – Testing and Commissioning

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with the Township of Levittown Standards.

B. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

C. Comply with NFPA 70.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Protect from construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Wiring Devices:
   b. Eagle Electric Manufacturing Co., Inc.
   c. Hubbell Incorporated; Wiring Device-Kellems.
   d. Leviton Mfg. Company Inc.
   e. Pass & Seymour/Legrand; Wiring Devices Div.

2. Wiring Devices for Hazardous (Classified) Locations:
2.02 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.

B. Straight-Blade and Locking Receptacles: General-Duty grade.

C. GFCI Receptacles: Straight blade, non-feed-through type, Heavy-Duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with UL 498 and UL 943. Design units for installation in a 2-3/4-inch-deep outlet box without an adapter.

2.03 SWITCHES


B. Snap Switches General-Duty grade, quiet type.

C. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.


2. Receptacle: NEMA WD 6, Configuration 5-15R.

2.04 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.

2. Material for Finished Spaces: 0.035-inch-thick, satin-finished stainless steel.

3. Material for Wet Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."
2.05 FINISHES

A. Color:

1. Wiring Devices Connected to Normal Power System: Ivory, unless otherwise indicated or required by NFPA 70.


PART 3 EXECUTION

3.01 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

C. Remove wall plates and protect devices and assemblies during painting.

3.02 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.03 CONNECTIONS

A. Ground equipment according to Division 16 Section "Grounding and Bonding."

B. Connect wiring according to Division 16 Section "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
3.04 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements.

2. Test GFCI operation with both local and remote fault simulations according to manufacturer's written instructions.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION
SECTION 16150

WIRING CONNECTIONS

PART 1  GENERAL

1.01  DESCRIPTION

A. This section includes the following:

1. Complete furnishing and installing of electrical connections to equipment specified under this Division and other Divisions or furnished by SEPTA.

2. Make all final connections, and leave apparatus in approved operating condition.

3. Provide materials, labor, tools, equipment, supervision, and all appurtenances as required for complete electrical connections to all equipment.

1.02  RELATED SECTIONS

A. Section 16010 – Electrical Requirements

B. Section 16050 – Basic Electrical Materials and Methods

C. Section 16060 – Grounding and Bonding

D. Section 16070 – Hangers and Supports

E. Section 16075 – Electrical Identification

F. Section 16120 – Conductors and Cables

G. Section 16130 – Raceways and Boxes

H. Section 16140 – Wiring Devices

I. Section 16400 – Low-Voltage Distribution

J. Section 16410 – Enclosed Switches and Circuit Breakers

K. Section 16442 - Panelboards

L. Section 16510 – Interior Luminaires

M. Section 16525 – Site Lighting
N. Section 16530 – Emergency Lighting
O. Section 16730 – AVPA Systems for Heavy Rail
P. Section 16880 – Electrical Resistance Heating

1.03 QUALITY ASSURANCE
A. Perform work in accordance with the Township of Levittown Standards.
B. Comply with NFPA 70.
C. Perform Work in accordance with NECA Standard of Installation.

PART 2 PRODUCTS

2.01 GENERAL
A. Equipment and materials as specified elsewhere in Division 16 or as indicated on the Drawings.

PART 3 EXECUTION

3.01 GENERAL
A. Equipment Variations: Note that equipment sizes and capacities as shown on the Contract Documents are for bidding purposes and as such may not be the exact unit actually furnished. Contractor shall anticipate minor variations in equipment and shall include in his Bid all costs required to properly connect the equipment actually furnished.
B. Verification: Obtain and review shop drawings, product data and manufacturer’s instructions for equipment furnished by others. Examine actual equipment to verify proper connection locations and requirements.
C. Coordination: Sequence electrical rough-in and final connections to coordinate with installation and start-up schedule and work by other trades.

3.02 ROUGH-IN
A. Provide all required conduit, boxes, fittings, wire, connectors and miscellaneous accessories, etc. as necessary to rough in and make final connections to all equipment requiring electrical connections.
B. In general, motors and equipment shall be wired in conduit to a junction box (or safety switch) near the unit and from there to the unit in flexible metal or liquid-tight flexible metal conduit.

3.03 CONNECTIONS

A. Provide properly sized overload and short circuit protection for all equipment connected, whether furnished under this Contract or by others.

B. Verify a proper connection with manufacturer’s published diagrams and comply with same.

C. Verify that equipment is ready for electrical connections, wiring and energization, prior to performing same.

D. Provide all control wiring to remote devices or equipment as indicated or required. Modify equipment control wiring, install or disconnect jumpers, etc. as required.

END OF SECTION
SECTION 16400
LOW-VOLTAGE DISTRIBUTION

PART 1 GENERAL

1.01 DESCRIPTION
A. This section specifies furnishing and installing interior electrical distribution and underground electrical feeds for site lighting.

1.02 QUALITY ASSURANCE
A. Reference Standards:
   1. National Electrical Manufacturers Association (NEMA):
      a. NEMA AB-1 Molded Case Circuit Breakers
      b. NEMA PB-1 Panelboards
      c. NEMA Type 3 Enclosure
   2. National Electrical Code (NEC):
      a. Article 230 – Services

1.03 RELATED WORK
A. Division 2 – Site Work
B. Division 3 – Concrete
C. Section 16010 – Electrical Requirements
D. Section 16050 – Basic Electrical Materials and Methods
E. Section 16060 – Grounding and Bonding
F. Section 16070 – Hangers and Supports
G. Section 16075 – Electrical Identification
H. Section 16120 – Conductors and Cables
I. Section 16130 – Raceways and Boxes
J. Section 16150 – Wiring Connections
K. Section 16442 – Panelboards
L. Section 16510 – Interior Luminaires
M. Section 16525 – Site Lighting
N. Section 16530 – Emergency Lighting
O. Section 16730 – AVPA Systems for Heavy Rail
P. Section 16880 – Electric Resistance Heating
Q. Section 16970 – Testing and Commissioning

1.04 QUALITY ASSURANCE
A. Comply with the National Electrical Code (NFPA 70)
B. Perform work in accordance with the Township of Levittown Standards.

1.05 SUBMITTALS
A. Submit the following in accordance with Section 01300:
   1. Manufacturers' Catalog cuts of all equipment to be furnished under the specifications.

PART 2  PRODUCTS

2.01 WEATHERPROOF ENCLOSURE
A. Outdoor enclosure for panelboard and meter shall be SEPTA's standard enclosure of appropriate size and furnished with a CORBIN 1103 lock.

2.02 CURRENT TRANSFORMER CABINET
A. Current Transformer Cabinet shall be in accordance with Philadelphia Electric Company (PECO) Electric Service Requirements and approved by PECO. Cabinet shall be NEMA 4R.

2.03 METER SOCKET
A. Meter sockets shall be in accordance with Philadelphia Electric Company (PECO) Electric Service Requirements and approved by PECO.
2.04 UNDERGROUND DUCT LINES

A. Duct lines shall be encased in concrete and shall form a common duct bank where power run in parallel with the AVPA system (and CCTV system).

B. Duct banks shall consist of individual conduits of Schedule 40 polyvinyl chloride (PVC). Conduits shall be as manufactured by Allied tube Company, Amoco or Carlon.

C. A continuous bare stranded copper grounding conductor shall be provided in all duct banks. Conductor shall carried with the phase conductors. The size of the grounding conductor shall No. 4/0 unless otherwise noted

PART 3 EXECUTION

3.01 INSTALLATION

A. Install weatherproof enclosures, current transformer cabinet (CTC), meter socket and all wire, fittings, connections and miscellaneous hardware as indicated on the drawings and as required to provide a complete installation free of defects or omissions.

B. Coordinate the installation and service connections with PECO, notifying them sufficiently in advance of required service data.

Philadelphia Electric Company
Philadelphia, PA 19101
Mr. Al Prenderdast
Telephone: (215) 841-3515
Fax: (215) 841-5683

C. PECO charges or fees for electrical service installation will be billed to and paid by SEPTA.

3.02 UNDERGROUND DUCT LINES

A. Duct lines shall slope downward to handholes and away from buildings, with a pitch of not less than 3 inches in 100 feet. The top of the concrete envelope shall be not less than 24 inches below finish grade or paving. Changes in direction exceeding a total of 10 degrees (either vertically or horizontally) shall be accomplished by the use of manufactured bends. Conduits shall terminate in end bells where duct lines enter handholes.
B. Conduit end bells, flexible couplings and expansion joints shall be provided as necessary. Fitted plastic or other tough non-metallic fitted couplings providing a water-tight joint may be used.

3.03 INSPECTION AND TESTING

A. Inspection and testing of the installations shall be in accordance with PECO's Electric Service Requirements.

END OF SECTION
SECTION 16410
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes the following individually mounted, enclosed switches and circuit breakers:

1. Fusible switches.
2. Nonfusible switches.

1.02 RELATED SECTIONS

A. Section 16010 – Electrical Requirements
B. Section 16050 – Basic Electrical Materials and Methods
C. Section 16060 – Grounding and Bonding
D. Section 16070 – Hangers and Supports
E. Section 16075 – Electrical Identification
F. Section 16120 – Conductors and Cables
G. Section 16130 – Raceways and Boxes
H. Section 16400 – Low-Voltage Distribution
I. Section 16442 – Panelboards
J. Section 16970 – Testing and Commissioning

1.03 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers’ technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250,
Type 1.
2. Current and voltage ratings.
4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Manufacturer's field service report.
   1. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with the Township of Levittown Standards.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Protect from construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
2.02 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products.
   2. General Electric Co.; Electrical Distribution & Control Division.
   4. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type GD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Nonfusible Switch, 600 A and Smaller: NEMA KS 1, Type GD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
   3. Auxiliary Contact Kit: Auxiliary set of contacts arranged to open before switch blades open.

2.03 MOLDED-CASE CIRCUIT BREAKERS AND SWITCHES

A. Manufacturers:
   1. Eaton Corporation; Cutler-Hammer Products.
   2. General Electric Co.; Electrical Distribution & Control Division.
   5. Square D/Group Schneider.

B. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.


3. Electronic Trip-Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and $I^2t$ response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.

5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.


C. Molded-Case Circuit-Breaker Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.

2. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and conductor material.

3. Application Listing: Type SWD for switching fluorescent lighting loads; type HACR for heating, air-conditioning, and refrigerating equipment.

4. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.

5. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
D. Molded-Case Switches: Molded-case circuit breaker with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

E. Molded-Case Switch Accessories:
   1. Lugs: Mechanical style with compression lug kits suitable for number, size, trip ratings, and material of conductors.
   2. Application Listing: Type HACR for heating, air-conditioning, and refrigerating equipment.
   3. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay. Provide "dummy" trip unit where required for proper operation.
   4. Auxiliary Switch Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
   5. Key Interlock Kit: Externally mounted to prohibit operation; key shall be removable only when switch is in off position.

2.04 ENCLOSURES

A. Section 16130 – Raceways and Boxes.
   1. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
   2. Enclosures in hazardous locations must be carefully selected to meet the division and group listing of the environment.
   3. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
3.02 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 16 Section "Electrical Identification."

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.

2. Verify switch and relay type and labeling verification.

3. Verify rating of installed fuses.

4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

C. Perform the following field tests and inspections and prepare test reports:

1. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with
new units and retest.

a. Instruments, Equipment and Reports:

1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

2) Prepare a certified report that identifies enclosed switches and circuit breakers included and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.06 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION
SECTION 16442
PANELBOARDS

PART 1    GENERAL

1.01    STIPULATIONS

A. The specifications sections “General Conditions,” “Special Requirements,” and “General Requirements” form a part of this section by this reference hereto and shall have the same force and effect as if printed herewith in full.

B. Drawings and general provisions of Contract, including all Division 1 and 2 Specification Sections, apply to this Section.

1.02    RELATED SECTIONS

A. Section 16010 – Basic Electrical Requirements.
B. Section 16050 – Basic Electrical Materials and Methods.
C. Section 16060 – Grounding and Bonding.
D. Section 16120 – Conductors and Cables.
E. Section 16130 – Raceways and Boxes.

1.03    APPLICATION

A. Section 16000 Electrical General Requirements applies to this section with additions and modifications specified herein.

1.04    DESCRIPTION

A. The Contractor shall furnish and install at locations as shown on the drawings approved panelboards of a type indicated and specified herein.

B. Panelboards shall comply with the following industry standards.

1. UL Listing/Approval.

2. UL Standards.
   b. Cabinet and Boxes – UL 50.

4. Applicable NEMA Standards.

PART 2 PRODUCTS

2.01 PANELBOARDS – BRANCH CIRCUIT

A. Panelboards shall be provided with separate ground bus. All buses shall be copper. Except for service-entrance panels, neutral busses shall be insulated from ground. Provide ground bus as indicated. Three-phase panelboards shall be sequentially phased.

B. All current carrying parts of panelboards shall be sized and tested in accordance with the requirements of the Underwriters’ Laboratories, Inc. AH panels shall be UL listed and labeled. Panels used for service entrance shall be labeled for such use.

C. Circuit breakers shall be readily removable from the front of panelboard without disturbing adjacent units. They shall have quick-make and quick-break toggle mechanisms, non-fusible contacts with inverse time, short circuit characteristics, screw on type. Breakers shall trip on overload. They shall indicate clearly whether they are in the open or closed position. Multi-pole units shall have thermal element in each pole and shall have a single handle.

D. Provide breakers of the size and type required by the specified voltage, trip rating and interrupting capacity.

E. Circuit directory holders shall be metal frames welded to the inside of each cabinet door and have heavy-duty transparent cover. Under this cover a neatly typed schedules outlining circuit control shall be placed. Contractor shall take care that room numbers or names shall be those actually assigned upon occupancy by building owner, rather than those assigned on project drawings. Failure to do so will result in order to re-label panel schedules.

F. All locks for lighting power and miscellaneous panelboards, control and communication system cabinets, and all other electrical systems having locked apparatus shall be keyed alike.

G. Where high-interrupting capacity, magnetic-only, current-limiting, or other special breakers are specified or noted, they shall be furnished as specified.
H. Panelboards shall be as manufactured by General Electric, Square D, Cutler Hammer or ITE. Panelboard assembly shall be enclosed in a code gage steel cabinet. The rigidity and gauge of steel shall be as specified in UL Standard 50 for cabinets. The size wiring gutters shall be in accordance with UL Standard 67. Cabinets shall be equipped with latch and tumbler-type lock on door for trim. Provide gray baked enamel finish electrodeposited over cleaned phosphatized steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. All cabinets shall be provided with the proper number and size openings for conduits installed. No openings shall be permitted which are not to be activated.

B. Instances where it is indicated or necessary to group-install cabinets, all cabinets and trims shall be same size, and shall be aligned.

3.02 CIRCUIT IDENTIFICATION

A. Branch circuits shall be distinctly numbered. Poles shall be numbered sequentially, i.e., all pole spaces shall be assigned sequential numbers even if not presently active; so that renumbering will not be necessary if breakers are inserted into spaces in the future. Panelboard wiring shall be tagged at each circuit breaker with proper circuit number. All conductors shall be long enough to reach any breaker in the panel, and shall be trained and laced neatly in gutters.

3.03 BALANCING OF LOAD

A. Balance the loads among the phases on all panelboards to within 10%. Certify on company letterhead that this has been done. Submit 3 copies to design professionals.

END OF SECTION
SECTION 16510
INTERIOR LUMINARIES

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes the following:
   1. Interior lighting fixtures, lamps, and ballasts.
   2. Emergency lighting units.

1.02 RELATED SECTIONS

A. Section 16010 – Electrical Requirements
B. Section 16050 – Basic Electrical Materials and Methods
C. Section 16060 – Grounding and Bonding
D. Section 16070 – Hangers and Supports
E. Section 16075 – Electrical Identification
F. Section 16120 – Conductors and Cables
G. Section 16130 – Raceways and Boxes
H. Section 16150 – Wiring Connections
I. Section 16530 – Emergency Lighting
J. Section 16970 – Testing and Commissioning

1.03 SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
   2. Emergency lighting units including battery and charger.
5. Life, output, and energy-efficiency data for lamps.

6. Photometric data, in IESNA format, based on laboratory tests of each lighting fixture type, outfitted with lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

   a. For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by the manufacturer.

B. Shop Drawings: Show details of nonstandard or custom lighting fixtures. Indicate dimensions, weights, methods of field assembly, components, features, and accessories.

C. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

   1. Lighting fixtures.

   2. Structural members to which suspension systems for lighting fixtures will be attached.

D. Samples for Verification: Interior lighting fixtures designated for sample submission in Interior Lighting Fixture Schedule. Each sample shall include the following:

   1. Lamps: Specified units installed.

   2. Accessories: Cords and plugs.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with the Township of Levittown Standards.

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers’ laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
D. Comply with NFPA 70.

E. FMG Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FMG.

1.05 DESIGN OR PERFORMANCE REQUIREMENTS

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.06 QUALIFICATIONS

A. Qualification Data: For agencies providing photometric data for lighting fixtures.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Protect from construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.08 OPERATIONAL AND MAINTENANCE DATA

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1.09 WARRANTY

A. Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Emergency Lighting Unit Batteries: 5 years (Manufacturer’s warranty) from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining four years for lead acid or lead calcium batteries.

B. Warranty Period for Electronic Ballasts: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer
agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 3 years (Manufacturer’s warranty) from date of Substantial Completion.

1.10 MAINTENANCE AND EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

3. Battery and Charger Data: One for each emergency lighting unit.

4. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

5. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include specified manufacturers or approved equals.

   a. Hubbell Lighting, Inc.

   b. Columbia Lighting, Inc.

   c. Lithonia Lighting.

2. Basis-of-Design Product: The design for each lighting fixture is based on the product named. Subject to compliance with
requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. LED Fixtures: Comply with UL 1598.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White Surfaces: 85 percent.

2. Specular Surfaces: 83 percent.

3. Diffusing Specular Surfaces: 75 percent.
   a. Laminated Silver Metallized Film: 90 percent.
   b. Plastic Diffusers, Covers, and Globes:
   c. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   d. Lens Thickness: At least 0.125 inch minimum unless different thickness is indicated.
   e. UV stabilized.

4. Glass: Annealed crystal glass, unless otherwise indicated.

F. Electromagnetic-Interference Filters: Factory installed to suppress conducted electromagnetic-interference as required by MIL-STD-461E. Fabricate lighting fixtures with one filter on each ballast indicated to require a filter.
2.03 LED LAMPS

A. Color Temperature:
   1. Warm color: 2700-3500K range. comparison
   2. Cool color: 3600-5500K range.

B. Features and Performance:
   1. Average Life: Not less than 50,000 hours at rated current.
   2. Solid state, impervious to heat, cold shock and vibration.
   3. Low power consumption.
   4. Dimmable.

C. Energy – Brightness: Following is a typical Watts (Energy) vs. Lumens (Brightness) comparison:

<table>
<thead>
<tr>
<th>Incandescent</th>
<th>Lumens</th>
<th>CFL</th>
<th>LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>150W</td>
<td>2600</td>
<td>32-35W</td>
<td>25-28W</td>
</tr>
<tr>
<td>100W</td>
<td>1600</td>
<td>23-26W</td>
<td>16-20W</td>
</tr>
<tr>
<td>75W</td>
<td>1100</td>
<td>18-22W</td>
<td>+13W</td>
</tr>
<tr>
<td>60W</td>
<td>800</td>
<td>13-15W</td>
<td>8-12.5W</td>
</tr>
<tr>
<td>40W</td>
<td>450</td>
<td>9-11W</td>
<td>6-9W</td>
</tr>
</tbody>
</table>

D. Lumen Maintenance
   1. LM79 for LED lamps

2.04 LM80 for Fixtures. EXIT SIGNS

A. Description: Comply with UL 924; for sign colors visibility luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighting Signs:
   1. Lamps for AC Operation: Fluorescent, 2 for each fixture, 20,000 hours of rated lamp life.
   2. Lamps for AC Operations: LEDs, 70,000 hours minimum rated lamp life.
   3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
a. Battery: Sealed, maintenance-free, nickel-cadmium type.

b. Charger: Fully automatic, solid-state type with sealed transfer relay.

c. Operation: Relay automatically energizes lamp from batter when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.

d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.05 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 16070 "Hangers and Supports."

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.


E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.
F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 EXECUTION

3.01 INSTALLATION

A. Lighting fixtures: Set level, plumb, and square with ceilings and walls. Install lamps in each fixture.

B. Suspended Lighting Fixture Support:
   1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
   3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

C. Adjust aimable lighting fixtures to provide required light intensities.

3.02 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION
SECTION 16525
SITE LIGHTING

PART 1   GENERAL

1.01 DESCRIPTION

A. The work described in this section consists of exterior luminaries, poles and accessories.

1.02 RELATED SECTIONS

A. Section 03300 - Cast-in-Place Concrete: Foundations for poles.

1.03 REFERENCES

A. ANSI C78.379 - Electric Lamps - Incandescent and High Intensity Discharge Reflector Lamps - Classification of Beam Patterns.

B. ANSI C82.4 - Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).


1.04 PERFORMANCE REQUIREMENTS

A. Parking Area: Provide illumination levels and uniformity indicated on Drawings.

1.05 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Shop Drawings: Indicate dimensions and components for each luminaire which is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

1.06 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01700.

B. Accurately record actual locations of each luminaire.
1.07 OPERATION AND MAINTENANCE DATA
   A. Submit under provisions of Section 01700.
   B. Maintenance Data: Include instructions for maintaining luminaries.

1.08 DELIVERY, STORAGE, AND HANDLING
   A. Deliver, store, protect, and handle products to site under provisions of
      Section 01600.
   B. Accept products on site. Inspect for damage.
   C. Protect poles from finish damage by handling carefully.

1.09 COORDINATION
   A. Furnish bolt templates and pole mounting accessories to installer of pole
      foundations.

PART 2 PRODUCTS

2.01 LUMINARIES
   A. Furnish products as specified in schedule on Drawings.
   B. Lamp shall be of type and wattage as shown on the Fixture Legends.
      Pulse Start Metal Halide Fixture shall be manufactured by Holophane.
   C. Fixture shall bear the Factory Inspection Label of the Underwriters
      laboratories. Fixtures with visible frames shall have concealed hinges and
      catches. An approved safety arrangement shall be incorporated in the
      design of fixtures to prevent frame from becoming disengaged when
      relamping or cleaning. The Contractor shall submit shop drawings,
      descriptive data and a certified test report for each type of fixture to be
      installed.
   D. All LED lighting fixtures shall be provided with the proper driver, and shall
      be designed to have starting currents lower than operating currents.

2.02 LED LAMPS (REFER TO SECTION 16510)
   A. Provide light bars with accuLED optics.

2.03 POLES
   A. Products:
      1. Steel Poles
2. Light poles shall be square, straight, steel pole with black-painted finish and base suitable for anchor bolt mounting. Poles shall be equal to catalog no. SSS type as manufactured by Holophane Company or equivalent. Poles shall be furnished with hardware for mounting of one, two, or four fixtures as required.

PART 3 EXECUTION

3.01 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.
   1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.02 POLE INSTALLATION

A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearance: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings.
   1. Fire Hydrants and Storm Drainage Piping: 60 inches.
   3. Trees: 15 feet

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirement are specified in Division 3 section “Cast-in-Place Concrete.”

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
   1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
   2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
3. Install base covers, unless otherwise indicated.

4. Use a short piece of 1/2-inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole foundations set in concrete Paved Areas: Install poles with minimum of 6-inch wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.

F. Raise and set poles using web fabric slings (not chain or cable).

### 3.03 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fitting or treatment.

B. Steel Conduits: Comply with Division 16 Section “Raceways and Boxes.” In concrete foundations, wrap conduit with 0.010-inch-thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### 3.04 GROUNDING

A. Ground metal poles and support structures according to Division 16 Section “Grounding and bonding.”
   1. Install grounding electrode for each pole, unless otherwise indicated.
   2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

B. Ground nonmetallic poles and support structures according to Division 16 Section “Grounding and Bonding.”
   1. Install grounding electrode for each pole.
   2. Install grounding conductor and conductor protector.
   3. Ground metallic components of pole accessories and foundations.

### 3.05 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
1. Verify operation of photoelectric controls.

C. Illumination Tests:

1. Measurer light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):
   a. IESNA LM-64, “Photometric Measurements of Parking Areas.”
   b. IESNA LM-72, “Directional Positioning of Photometric Data.”

D. Prepare a written report of test, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner’s maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 1 Section “Demonstration and Training.”

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION

A. Section Includes: Requirements for inverter system, components, and related installations. Inverter System shall be furnished to provide a reliable source of power, and shall operate during a utility line deficiency without any interruptions of power supplied to the load. The transfer from utility power to battery power shall utilize a true no break system, pulse width modulated sine wave output to prevent sensitive loads from “winking out”. The system shall be capable of powering any combination of electronic, power factor corrected, fluorescent, incandescent or LED lighting; building management systems, motors, security systems and any other critical voltage or frequency-sensitive electronic loads. The system shall operate from 0-100% loading, and be rated to deliver its full KVA rating, at unity power factor, for a minimum of 90 minutes. A boost-tap transformer circuit shall be utilized to provide regulated output, during brownouts within -10% of incoming line voltage, without transferring to battery. Upon return of the normal AC utility line power, the system shall recharge the batteries within 24 hours without any interruptions of power supplied to the load.

1.02 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Section 16050 - Basic Electrical Materials and Methods

C. Section 16060 - Grounding and Bonding

D. Section 16070 - Hangers and Supports

E. Section 16075 - Electrical Identification

F. Section 16120 - Conductors and Cables

G. Section 16130 – Raceways and Boxes
1.03 SUBMITTALS

A. Make all submittals in accordance with Section 01300.

B. Shop drawings and manufacturers' literature shall be submitted and shall consist of single-line diagrams, assembly wiring diagrams, equipment drawings, breaker and fuse coordination curves, product description, and installation instructions. Shop drawings shall clearly indicate enclosure size, gutter space, breaker frame sizes and trips, main bus type and rating.

C. Manufacturer's installation instructions shall be submitted.

D. Operation and Maintenance Manuals shall be submitted and shall include detailed parts lists, lists of recommended spare parts, circuit diagrams, maintenance procedures, and operating instructions.

E. Certified copies of factory test results shall be submitted.

F. Installation Certificates shall be submitted as specified in Section 16050.

1.04 QUALITY ASSURANCE

A. Products for, and the execution of, the work of this Section shall satisfy the applicable requirements of the latest NEC Codes and Regulations of Jurisdictional Authorities, and the Occupational Safety and Health Act. Products shall satisfy the applicable requirements of ANSI, NEMA, UL, and ASTM.

B. The manufacturer shall be ISO 9001 certified.

C. Manufacturer Qualifications: The system manufacturer shall have field service organization staffed by factory trained field service engineers dedicated to the startup, maintenance, and repair of system equipment. The organization shall consist of regional and local offices, managed on a regional basis.

D. Factory Testing: Before shipment, the manufacturer shall fully and completely test the system to assure compliance with the specification. These tests shall include operational discharge and recharge tests on at least a one-minute battery plant to assure guaranteed rated performance.
1.05 DESIGN REQUIREMENTS

A. Furnish and install an Inverter System that will supply a minimum of 15 kVA and 15 kW at unity power factor at 60 Hz for a period of 1.5 hours upon interruption, brownout, or failure of the monitored AC utility line.

1.06 REFERENCES

A. Institute of Electrical and Electronic Engineers (IEEE)/America National Standards Institute (ANSI):

B. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code (NEC).

C. Federal Communication Commission:
   1. FCC Part 15, Sub-Part J, Class A requirements.

D. Underwriters Laboratories:
   1. UL1778 Standards for Uninterruptible Power Supplies.
   2. UL 924 Standard for emergency Lighting and Power Equipment

E. Manufacturer’s ISO 9001 Certification Program.

F. Occupation Safety and Health Administration (OSHA) requirements.

1.07 WARRANTY

A. Warranties, General: Special warranties specified in this Article shall not deprive the Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty for Inverter Systems: The system shall be guaranteed, under normal and proper use, against defects in workmanship and materials for a period of two years. Batteries supplied as part of the systems shall be covered under a separate pro-rata warranty as described below.
1. Sealed Lead Calcium, 20-year life expectancy (Type G) – One-
year full replacement warranty plus an additional fourteen years pro-rata.

1.08 MODES OF OPERATION

A. The inverter system shall operate as an on-line system in the modes listed below.
   1. The system’s operation is fully automatic. It uses a linear transformer, with boost tap and surge protection devices. The inverter shall be of the Pulse Width Modulated (PWM) design, and shall provide true “no break” power to the load at all times.
   2. During normal operation, the charger maintains the battery bank at full capacity. The three on-board microprocessors continuously monitor charger settings and system’s overall readiness. The system consists of circuitry including an automatic, multi-rate, software controlled charger; continuous self-diagnostics monitoring 265 various parameters, and programmable system testing capabilities. The system shall incorporate 30 individual alarms and 9 system logs. All Logs and Alarms are automatically recorded and readily displayed through the microprocessor controlled User Interface Display (UID). The system shall also include a RS232 Serial port for remote communications.
   3. The system’s automatic overload and short circuit protection in normal and emergency operations shall consist of 150% momentary surge capability, 120% overload for 5 minutes, and 110% overload for 10 minutes. The system protection shall also include a low battery voltage disconnect, AC input circuit breaker, a DC input fuse and switch, and an AC output fuse. The system shall supply a digitally generated sinusoidal output waveform (PWM) with less than 5% total harmonic distortion at rated linear load. A boost tap transfer protection circuit will maintain the desired output voltage during low voltage “brownout” situations, without continuously switching to batteries; thereby preserving battery capacity.

PART 2 - PRODUCTS

2.01 SYSTEM RATINGS AND OPERATING CHARACTERISTICS

A. Input Voltage:
1. The available input voltage to the systems shall be 208 volts, +10% to -15%, single phase, with a frequency of 60Hz. The system shall have an AIC rating of 65,000 RMS symmetrical amperes.

B. Output Voltage:
1. The available output voltage of the system shall be 120/208 volts, +/- 5%, single phase sine wave, with a frequency of 60Hz + 0.05Hz on inverter. The output frequency when on utility power shall be as supplied by the utility.

C. System Diagnostics:
1. The system's user interface display (UID) shall include an array of 5 LED lights; a 2-line 40-character LCD display, and keypad to control and monitor the system. The UID will be menu driven and will also have the ability to display individual system parameters using a corresponding number code (Hot Key). The array of LED lights shall monitor the AC Output presence (green), System Ready status (green), Battery Charging status (red), Inverter On (amber), and Alarm functions (red). The system shall provide for the displaying of all parameters, operating modes, alarms, and acknowledgment of alarms. To ensure only authorized personnel can operate the unit, the system shall be multi-level password protected for all control functions and parameter changes.
2. The system shall have a continuous scrolling display of the following meter functions: input AC voltage, output voltage, AC output amps, battery voltage, battery charging amps, battery discharge amps, output volt-amps (VA), output power (Watts), power factor, percent loading, input frequency, output frequency, ambient temperature, battery temperature, last inverter run time, total inverter run time, system run time, date and time. The system shall also have the capability to display all other meter functions via a menu driven display, or “Hot Key” commands. The system shall be completely microprocessor controlled providing continuous monitoring of all sub-systems to ensure system is operational in emergency situations. The system shall continuously monitor 265 parameters to insure readiness.

D. Alarms:
1. The system shall have 30 audible and visual alarms with automatic logging of the 25 most recent events. The system's alarm acknowledgement feature shall enable the user to silence only the current audible alarm(s) without silencing other alarms, or clearing the alarming condition until the fault has been addressed. Alarms shall monitor as a minimum; low, near low,
and high battery voltage, high AC input voltage, high and low AC output voltage, output volt-amp overload, low run time left; high ambient, heat-sink, transformer, and battery temperatures, temperature probe failure, system test failure, and circuit breaker tripped.

E. Manual and Programmable Testing:
   1. The system shall incorporate a manual test function and three automatic test modes. The user shall be able to perform a system test at any time. The system shall also perform a programmable, self-diagnostic test of its subsystems to ensure reliability, including a weekly, monthly, and annual test. Automatic recording of the last 20 test events shall be kept in their own separate Test Results Log.

2.02 BATTERY CHARGER

A. The charger shall be software controlled, temperature compensated, three-step float type charger, with equalize. The charger shall charge the batteries continuously during normal standby condition. Following a power failure the charger will start in constant current mode until battery voltage reaches Equalize. Equalize voltage will be maintained until charging current drops to 0.5 amps or 0.3% of the battery amp/hour rating; battery voltage will then be allowed to drop down to Float. Recharge time shall not exceed 24 hours.

2.03 BATTERIES

A. The batteries shall provide sufficient power to maintain the output voltage of the inverter for a period of 1.5 hours, without dropping below 87.5% of nominal battery voltage. The standard batteries shall be enclosed in a cabinet that permits easy maintenance without requiring removal. The following battery type shall be provided:
   1. Sealed Lead Calcium VRLA (G): Supplied in cabinets. Requires no addition of water over the life of the battery. 20-year design life expectancy at 77°F (25°C).

2.04 SYSTEM OPTIONS

A. The following factory installed equipment shall be supplied with the system:
   1. Output Circuit Breakers with Alarms:
      a. Provide 14 circuit breaker positions with alarms. Single pole 277V breakers shall use one position each.
2. **Internal Bypass Switch:**
   a. The Internal Bypass Switch (IBS) is a three-position “make-before-break” service switch mounted inside the unit. The IBS is compatible with all input/output voltage combinations and works with any quantity or combination of output circuit breakers.

3. **Remote Status Panel (RSP):**
   a. Permits greater flexibility and convenience to monitor the system operational status from a remote location, up to 1000 ft. This option allows the user to remotely monitor the status of the inverter via 5 LEDs and an audible alarm. The RSP provides the following indicators:
   1) Alarm LED (Red)
   2) Audible Alarm
   3) Charging LED (Red)
   4) Emergency Power LED (Yellow)
   5) Ready LED (Green)
   6) A/C On LED (Green)

2.05 **MECHANICAL**

A. The system shall be contained in a code gauge, NEMA 1 steel cabinet, finished in a scratch resistant, powder coat finish, with a key lock, and conduit knockouts at the top and sides, with front opening doors with air filters. Cabinets shall be designed to allow stacking to minimize the overall system’s footprint. The system shall include a plenum to expel heated air from inside the unit. All components must be front accessible. All components shall have a modular design and a quick disconnect means to facilitate field service.

2.06 **ACCEPTABLE MANUFACTURERS**

A. Dual-Lite, Spectron LSN Series Inverter System.

B. Or Approved Equal.

2.07 **UNDERCOATING**

A. Thoroughly coat the underside of the inverter system bases with a rust and corrosion resistant mastic conforming to the manufacturer’s standards, 4 mils thick.
2.08 CHANNEL SILLS

A. Furnish all steel channel sills required for the installation of the inverter system components.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure that the concrete equipment pad is level to within the manufacturer’s recommended tolerance and of correct size with all steel and anchor bolts in place.

3.02 INSTALLATION

A. Install equipment with skilled mechanical erection labor in accordance with manufacturer’s instructions.

B. Anchoring: Set inverter system on steel channel sills embedded in concrete pad. Install steel channel sills flush with top of concrete pad. Anchor bolts, which have been threaded into the embedded channel sills, shall be used for securing the equipment to the mounting surface. Accurately level and align each shipping section, and each component and set on shims and plates as required to level and align. Tighten anchor bolts.

C. Clearances and Protection: Maintain all clearances around inverter system to adjacent electrical equipment and wall surfaces.

D. All wiring shall be installed in conduit and shall be sized as required for voltage drop purposes to assure proper operation of connected loads. Input and output wiring shall enter the cabinet in separate conduits.

3.03 CONCRETE PADS

A. Provide concrete equipment pads as indicated on the Drawings.

B. Construct concrete equipment pads as follows:
   1. Coordinate size of equipment pads with actual equipment sizes provided. Construct pad 4 inches larger in both directions than the overall dimensions of the supported equipment.
   2. Install reinforcing bars, tied to frame, and place anchor bolts and sleeves to facilitate securing equipment.
3. Embed steel channel sills in concrete pad as specified in Paragraph 3.02B.
4. Place concrete and allow to cure before installation of equipment. Concrete work shall conform to Section 03300.

### 3.04 FIELD QUALITY CONTROL

A. Manufacturer shall provide a factory authorized technician to insure proper operation and installation of the LSN Inverter System. Manufacturer shall provide a highly trained Factory Authorized Technician to administer an on site point-by-point visual check of the system. Technician shall check all internal electrical connections, AC and Battery connections, system voltages and all system parameters. The system shall then power up and all systems parameters shall be tested, calibrated and recorded in. The technician shall also perform a Battery Discharge Test to insure proper battery capacity. If any malfunctions are detected, the technician shall remedy them while on site, or make arrangements to do so. The Technician shall instruct on site personnel on the operations and maintenance of the equipment.

B. Formalize Training: The Technician shall train on site SEPTA PM and SEPTA engineering personnel on the operations and maintenance of the equipment.

C. Unit Start-Up and Site Testing: Site testing shall be provided by the manufacturer's field service personnel and in the presence of SEPTA representative. Notify SEPTA at least one (1) week of scheduled start-up and site testing. Site testing shall consist of a complete test of the system and the associated accessories supplied by the manufacturer. A full load power test including a partial battery discharge test shall be provided as part of the standard start-up procedure. This shall be accomplished without disturbing user wiring and completed prior to operation of the site critical load from the output. The test procedure shall be used to verify the capability of the system output waveform with its load. The engineer shall be informed immediately of any test failures.

**END OF SECTION**
SECTION 16730

AVPA SYSTEMS FOR HEAVY RAIL

PART 1 GENERAL

1.01 DESCRIPTION

A. The Audio/Visual Public Address (AVPA) System consists of computers, software, Public Address Systems, Variable Message Signs and communications equipment to comply with Americans With Disabilities Act (ADA) requirements for both audio and visual messages to passengers at the transit station platforms. This system will provide an intelligent, synchronized messaging system to the passengers. The messages will include schedule, emergency, service, boarding, safety, and other types of information. The system shall be fully integrated with SEPTA's existing Audio/Visual PA System project. This section specifies the components of the system.

B. All new software required shall be obtained by the Contractor from the original AVPA system Contractor.

1. The Contractor that installed the original AVPA system is:

   General Electric Transportation Systems,
   Global Signaling, Advanced Communications Systems
   5 Shawmut Drive
   Canton, Ma 02021
   Tel: (800) 966-4075

C. The Contractor shall provide Variable Message Signs (VMSs), Station Control Units/computers (SCUs), Public Address (PA) speakers and microphones, and related sub-systems at the Levittown Station as shown on the Contract Drawings.

D. The Contractor shall provide the communications protocols for the VMS and PA Systems for integration into the AVPA System. The protocols provided shall include individual messages for control of the signs for programming, diagnosis, storage and access. This information shall be submitted to the SEPTA Project Manager for approval prior to purchasing any actual hardware. The equipment must be fully compatible with the existing AVPA System.
E. The Contractor shall furnish and install:

1. Variable Message Signs (VMS) as shown on the Contract Drawings.

2. PA system speakers and microphones as shown on the Contract Drawings.

3. Station Control Units (SCU) as shown on the Contract Drawings.

4. The wire and cable subsystems as shown on the Contract Drawings.

5. The electrical subsystems as shown on the Contract Drawings.

6. New rack-mount Control Center Server as specified herein.

7. The latest supported software upgrade to configure and operate the system. SCU computer software shall be GEisys or SEPTA approved 100 percent compatible software. The Contractor shall purchase any software licenses needed to expand the system.

   a. The Contractor shall design, create, configure and populate a new SEPTA AVPA database.

8. All required cabinets/enclosures with mounting and support hardware. Provide final breaker / panel information in AVPA cabinet. Refer to Section 16075, Electrical Identification Article 2.05.

F. The Contractor shall integrate and test all systems and components.

G. The Contractor shall obtain the existing message and word/phrases library (Database) for the existing AVPA System from the SEPTA Project Manager, and perform all necessary additions and modifications to the stored messages on the system. Also, the Contractor shall record, digitize and add to the audio database additional words and phrases required for the new station and system. The SEPTA Project Manager will provide the list of additional words and phrases along with the person whose voice is to be used. The Contractor shall record this information and add to the existing databases as necessary. All messages are generated from a single source to provide a consistent presentation to the passengers. All modified or new audio recordings shall be
consistent with the existing system. All newly developed messages shall be integrated to the existing AVPA System database.

H. The Contractor shall provide training on maintenance, configuration, operation and administration of the systems. Training shall be concentrated on hardware, software and operational modifications not currently implemented into the existing system. Training shall be provided in accordance with Section 01820, Demonstration and Training.

I. The Contractor shall install the equipment with minimum disruption to the operation of existing equipment.

1.02 RELATED DOCUMENTS

A. Division 1: General Requirements
B. Section 16010 – Electrical Requirements
C. Section 16050 – Basic Electrical Materials and Methods
D. Section 16070 – Hangers and Supports
E. Section 16075 – Electrical Identification
F. Section 16120 – Conductors and Cables
G. Section 16130 – Raceways and Boxes
H. Section 16140 – Wiring Devices
I. Section 16150 – Wiring Connections
J. Section 16410 – Enclosed Switches and Circuit Breakers
K. Section 16970 – Testing and Commissioning

1.03 SUBMITTALS

A. The Contractor shall submit:

1. Installation and Shop Drawings for all Audio/Visual PA systems
2. Record of verification of dimensions, layouts, device locations, cable and conduit, and conditions at the job site
3. Records of testing, documentation, field inspections, punch-lists, acceptance testing, and final demonstrations of system
and documentation

1.04 QUALITY ASSURANCE

A. Qualifications:

1. The Manufacturer(s) of the system equipment shall be submitted to SEPTA for approval. The Contractor shall provide all of the data required for SEPTA evaluation. The Contractor shall certify that all proposed Manufacturer shall comply completely with all the requirements of this Contract.

2. The Work shall be performed by a professional Audio/Visual System Contractor who has demonstrated experience and abilities with systems of this size and complexity (proven successful installation and testing of similar products/systems).

3. The Contractor shall be an authorized systems integrator of all major AVPA equipment components supplied and such information shall be supplied by the Bid Opening date.

B. Quality of Materials:

1. All materials and equipment supplied by the Contractor shall be new and of the latest supported hardware and meet or exceed the latest published specification of the Manufacturers' in all respects.

1.05 APPLICABLE PUBLICATIONS

A. National Electrical Code (NFPA 70)

B. All other publications are located in Section 01090, References.

1.06 SYSTEM REQUIREMENTS

A. The new AVPA system shall control the Levittown Station at the Control Center.

B. The station depicted in the Contract Drawings shall have a Station Control Unit (SCU), Variable Message Signs (VMS), speakers, microphone, and associated equipment. The SCU shall control the PA system and the signs.

C. The Audio/Visual PA System shall be proposed and provided as a complete system, including but not limited to, SCU, Variable Message Signs, speakers, microphones, etc.
D. A station microphone shall be provided on the platforms as shown on the Contract Drawings. The equipment and its enclosure shall be limited access (keyed), vandal proof and weatherproof.

E. The system shall be designed to have the Station Control Unit operate the audio/visual announcements at each station. The system shall have the capability to interface with and control a minimum of three (3) discrete audio/visual announcement zones at each station (e.g., NB platform, SB platform, Waiting Room). The Station Control Unit shall have a database for the audio/visual text files. The database shall be maintainable from the existing central server. The system shall provide for live audio/visual announcements from the Control Center both in the form of immediate audio/visual text files and voice generated from the Control Center(s) and authorized station personnel. All equipment at the stations including the signs, PA and Station Control Unit shall acknowledge all Control Center and station messages, thus providing positive feedback to the system users.

F. Future expansion capability for additional stations has been incorporated into the design of the existing system. The system is designed to provide expandability to all existing SEPTA stations through LAN administration configuration methods only. Additional central software and hardware is not required. The system user interface is designed to adapt to any station expansion without software modifications. The Contractor shall ensure that all expansion capability for the remaining stations is maintained.

G. The physical installation of all AVPA equipment shall be coordinated with fixed signage, exit signs, platform structures, and/or other equipment.

H. The station control equipment shall provide diagnostics information to the Control Center upon request.

I. The SCU shall operate on the same software as the existing AVPA System to ensure compatibility. This includes: latest supported Windows operating system, GE-ISYS SCU and Real VNC for remote access control.

1.07 EXISTING SYSTEM FUNCTIONALITY

A. The existing graphical user interface is designed to operate under SEPTA’s latest supported operating system or approved equivalent.

B. The existing AVPA System includes databases that provide scheduled messages to automatically be delivered to the station
AVPA system. These databases are relational and available through the SEPTA Project Manager. The Contractor shall provide a new database for the Levittown AVPA system.

C. The existing AVPA System has the ability to import database information on a dynamic update basis using commercial access applications.

D. The AVPA System supports pre-recorded audio messages with synchronized visual messages displayed on the Variable Message Signs. The system also allows for "live" message transmission by several methods. The first method is accomplished by a supporting window on the operator interface. The operator types in the text of the desired message, and then uses the typed message as a script to create the audio portion of the message. The message is then sent out with the audio and visual text synchronized. The second method allows the operator to either select a generic visual text message with an operator defined audio message. The operator has the ability to eliminate the visual message and just provide the operator defined audio message. This option might be used during time critical emergencies where the situation may not allow for the operator to type a message.

E. The existing AVPA System has the ability to log all messages presented to the passengers. The log is generated and recorded by the station SCUs and at the operational Control Center. All messages from each station are logged at the SCU(s), and are remotely retrievable. Included in the system log are the date, time, location, message identifier, message type, and other message information. The log can only be accessed by the system administrators. Capacity to hold thirty (30) days logging is provided. Archival storage of the log files is provided. Each SCU can generate a log of all messages at the station and send the log entries to the Control Center server(s). Included in the log is the detection of use of the microphone and all audio/visual messages attributes. The actual audio/visual text is not required but the message identifier shall be required. All log files are ASCII flat text files delimited by commas. The server log file is contained on removable media as a read only file.

F. The existing AVPA System supports the creation, maintenance and update of text messages corresponding to the prerecorded audio messages. The full 128 character standard ASCII character set, as well as selected international characters, and pixel graphics are available for these messages. Text messages are displayed on Variable Message Signs at the platforms simultaneously with the broadcast of the corresponding audio message. While prerecorded
audio messages shall be stored at the SCUs, the display of test
messages may be handled either by transmitting the text
simultaneously with the audio message, or by downloading and
storing the message upon creation or modification, and invoking it
by transmitting a tag identifier with the prerecorded audio message
to the SCU.

G. The existing AVPA System includes a Graphical User Interface
(GUI) on the operator AVPA Workstations. Workstations run on
GE-ISYS software to facilitate control of the AVPA system. This
software was provided by General Electric Systems, GS, ACS. The
stations included in this Contract shall be configured into the
upgraded AVPA workstations and shall be controlled by the existing
Audio/Visual PA System.

H. The Control Center has the ability to change the messages on any
VMS. The Control Center is equipped with an existing Single Line
VMS and audio playback system for review of the messages before
the messages are propagated to the station. The existing system
also provides the ability to selectively hear the audio announcement
messages in the Control Center.

I. The operator initiates control of one or more station units by
selecting the appropriate station(s) including, but not limited to:

1. All stations
2. Group of individual stations
3. Single station, i.e. 30th Street
4. Single or multiple PA Zones at a station, with simultaneous or
   sequential audio/visual announcements across selected or all
   zones

J. The operator interface includes pull-down menus and related icons
to perform message selection, creation, editing, management,
storage, and transmission. In addition, the operator interface has a
diagnostics and performance-monitoring window.

K. The existing Audio/Visual PA System file server(s) include
electronic data storage of sufficient size to accommodate the
message database. The storage method includes a complete
redundant backup system. The message database has a capacity
of 5000 messages, (or segments to assemble 5000 messages),
with the capability to expand to more than 20,000 messages (or
segments to assemble 20,000 messages). The nominal audio
message is 30 seconds or approximately 300,000 bytes of digitized
audio. Messages composed of assembled multiple message phrases shall be audibly smooth and contiguous.

L. The SCUs provide diagnostics information to the Control Center upon request or automatically when a failure is detected. The Control Center AVPA workstations are capable of detecting and displaying system and station faults. The faults include but are not limited to:

1. Sign communications failure (non-responsive unit).
2. Sign electronics service required.
4. Station Control Unit communications failure with signs, Message
5. Selection Device/Keypads, Control Center computers, and/or Public Address components
6. Station Control Unit service required.
7. Station Control Unit self-diagnostics failure
8. Software/operating system faults

M. The Audio/Visual PA System network uses TCP/IP network protocol. During normal operation or in the event of a failure, the Audio/Visual PA System network shall not affect performance or operation of the other networks, and vice versa.

N. The Audio/Visual PA System includes an Administrative/Backup Workstation to allow system management and message creation off-line, away from the operator consoles. The Workstation is capable of running the same operator interface as proposed for the Operator AVPA Workstations. The Administrative/Backup Workstation has the ability to monitor the performance of the other AVPA Workstations and system components.

1. The Contractor shall provide and configure new operational and diagnostic reporting functions for the new Levittown AVPA system using new Crystal Reports.

O. The Operator AVPA Workstations have graphic indications showing the state of operation of the local station equipment. When the station Audio/Visual PA System is in use, the Control Center Operator Workstation(s) graphically indicate such.
P. The Operator AVPA Workstations have the ability to remotely obtain from the station control equipment diagnostic and maintenance information regarding Variable Message Signs, Public Address Systems, and SCUs. The ability to retrieve diagnostics and maintenance information is dependent on the access rights of the individual operator using the AVPA workstation. The Public Address System does not provide diagnostic information to the SCU.

Q. The Operator AVPA Workstations verify all outgoing station requests. Any outgoing station request failures are presented via the GUI by the system to the Operator AVPA Workstations with a failure indication, type and description.

R. The systems’ capacities and software accounts for all existing SEPTA stations plus 30% spare capacity.

S. The Control Center AVPA Workstations include capabilities to use all features and functions of the LED signs, both the single line and full matrix types. All LED sign features and functions shall be integrated into the operational software of the system.

T. All system components are time synchronized from the file servers.

U. Existing message display operational characteristics include the following:

1. Frequency of Train messages are displayed twice before any other same or lower priority message is displayed. All other messages, with the exception of emergency priority messages are displayed twice but only one message before the train frequency message is displayed again.

2. Other service messages are displayed in static display segments of 2 seconds each. Segments appear without scrolling and immediately blank and change to next segment at the end of display period. They are shown only once before a different message is displayed. A 3 second blank display is shown between different message types.

3. Emergency Priority Messages take priority over all other messages and are displayed continuously as long as necessary. These messages are shown over the entire sign for as long as conditions exist, or scrolled from right to left. Emergency messages start with the phrase “ATTENTION” for evacuation, and “YOUR ATTENTION PLEASE” for all other messages.
4. Frequency of Train messages display 3 seconds per message segment. Message segments blank and immediately change to next segment at end of display period. Between repetitions of the message there is a 1 second blank display. Between this set of messages and the next type of message there is a 2 second blank display.

5. Current date and time message displays for 5 seconds. This is a background priority message.

1.08 TYPICAL STATION EQUIPMENT REQUIREMENTS

A. The Audio/Visual PA System at the Levittown Station shall be a computer controlled, modular system, providing local audio control from the station microphone or remotely from the Control Center. All new equipment shall be integrated into the existing Audio/Visual Public Address System at the Control Center.

B. The station shall have a minimum of one (1) operator microphone. If there are multiple PA Zones at the station, the microphone shall be able to announce at each PA Zone individually and at all PA Zones simultaneously.

C. The station shall be provided with LED Variable Message Signs (VMS). The Variable Message Signs shall be grouped into the appropriate PA Zone, as indicated on the Contract Drawings.

D. Each AVPA SCU located at the station shall be equipped with eight (8) logic input points and eight (8) logic output points. Individual messages for that station shall be triggered to play by the input points. Individual messages for that station shall trigger the output points. The configuration of these input/output message points shall be assignable from the Control Center AVPA workstations.

E. The station Control Unit shall have its own station address code and shall respond with a unique station verification code sent on the up-link after it has received the correct address. The equipment shall acknowledge the corresponding station by indicating a status icon on the operator interface, indicating to the operator that this station has indeed been addressed.

F. The addressed remote unit shall close the audio path from the down-link (talk out) automatically upon receiving the station select code.

G. Station-level components of the Audio/Visual PA System shall include the following elements: audio switching, audio processing, microphone-speakers, PA Amplifier and SCU.
H. The station Audio/Visual PA System shall deliver adequate sound levels to its coverage area. Speaker locations are as shown in the Contract Drawings, however the Contractor shall be responsible for providing adequate coverage, and shall propose any modifications to equipment placement which may be required in order to improve coverage for approval by SEPTA. The speaker volume level shall exceed the average background noise by 15 to 20 dB, but in no case shall volume at the ear level exceed 95 dB. Each speaker shall have an adjustable multi-tap transformer for control of individual speaker volume levels.

I. The operation of the Audio/Visual PA System at the stations shall be managed at all times by a priority function. The system shall use priorities to manage users in the system, allowing the higher priority users to preempt lower priority ones in order to make an announcement, and preventing simultaneous system usage. User priorities shall be as follows, but shall be configurable:

Highest Priority: Station attendant via a microphone
Station attendant via a message selector
Control Center workstation

Lowest Priority: SCU automated database.

J. The control center operator shall be denied access to a particular station until such time as the attendant, at that station, has completed with their announcement.

K. The local microphone enclosure shall be stainless steel, rugged, weatherproof and vandal resistant with keyed access and located in such a way that access can be limited using a keyed entry as opposed to pad locks.

L. The station SCU shall have an interface to the Public Address System, Variable Message Signs and the Control Center.

M. The station SCU shall have a database with capacity for 500 locally stored audio/visual messages. The database shall be configured, loaded, programmed and reprogrammed from the Control Center.

N. The Audio/Visual PA Systems shall log all messages presented to the passengers (last 30 days of messages with message ID, time/date stamp, and play characteristics, minimum).

O. Signs shall be ASCII text driven. Display of message on sign must commence in less than 500 ms after delivery of ASCII text data to sign. Sign protocol must support acknowledge of display of text.
message. Attributes of sign display shall be by escape sequence or similar control methodology. Escape sequences shall be imbedded in the ACSII text stream applied to one or more select display characters. Attributes such as color, blinking and reverse video are to be controlled utilizing escape sequences.

P. All station equipment shall automatically initialize and operate from power on. The equipment shall automatically recover from interruption of power and/or communication loss. Upon power up, all equipment shall perform power on self-tests and report the results to the Control Center. Upon the loss of communication to the main servers, located at 1234 Market Street, the SCU shall re-establish communications upon the power up of the main servers.

Q. All station equipment shall have power filtering, fault detection and protection to prevent equipment damage from environmental conditions and/or circuit failures.

R. All station equipment shall have lightning protection on the incoming and outgoing communication wiring to prevent equipment damage from environmental conditions.

S. The station control equipment shall provide feedback to the control center for all control center requests.

T. The station control equipment shall provide system status to the control center.

U. One Station Control Unit shall be located in the cabinet inside the local Communications Room at the station unless otherwise noted on the Contract Drawings. The designated cabinet is shown on the Contract Drawings. Final SCU locations shall be coordinated with the SEPTA Project Manager.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Temperature

1. Communications Cabinet Equipment

   a. The maintenance cabinet equipment shall be designed, fabricated, and environmentally tested to operate in the temperature range between -25 degrees Celsius (C) and 63 degrees C with a relative humidity range of 5 percent to 95 percent, non-condensing.
2. Exterior Equipment

a. Exterior equipment such as externally mounted VMS, speakers, conduits, electrical contacts, etc. shall be designed, fabricated, and environmentally tested to operate in the temperature range between -25 degrees C and 63 degrees C with a relative humidity range of 5 percent to 95 percent, non-condensing.

3. All Audio/Visual PA Equipment shall comply with the following environmental requirements.

a. Variable Message Sign assembly consisting of electronic sign components and sign case enclosure shall operate with no discernable degradation while operating within the parameters identified in Exhibit 16730-1.

4. All other components of the Audio/Visual system shall operate with no discernable degradation between 0 degrees Celsius and 40 degrees Celsius, 5 to 95 percent relative humidity (non-condensing).

B. Weather & Elements

1. All potentially exposed units, shall be designed and tested to operate continuously and reliably in varying conditions of humidity, rain, salt, dust, cleaning detergents, water spray, roadway chemicals, exhaust emissions, and other contaminants found in the transportation areas. This means that appropriate rain/corrosion/ tightness testing shall be conducted for all equipment. All Exterior components shall be designed and finished to resist adverse effects from solar radiation.

C. Electromagnetic and Electrostatic Susceptibility

1. System equipment shall not be adversely affected by radiated or conducted electromagnetic or electrostatic interference from other onboard or fixed site equipment or from normal usage on or near public transit areas. Certain tests for electromagnetic interference and Electrostatic Discharge (ESD) susceptibility are required. These conditions shall include, but not be limited to fixed site, portable, and mobile radio interference, incidental (spurious) radiation, ignition noise, lighting fixture (static) interference, electrical power system transients, vehicular systems interference, and electrostatic discharge (air or contact).
2. The Contractor shall investigate all environmental factors that may affect equipment operations both before and after installation of the equipment, including shock and vibration. Environmental deficiencies uncovered during installation testing, on-line demonstration, or final tests may be cause for additional design adjustments and additional environmental testing by the Contractor. SEPTA shall retain the exclusive right to judge the environmental acceptability of the components before final acceptance.

D. Electrical Power

1. All components shall be certified via testing to operate with normal outputs when the input voltage varies as much as +/- 10 percent.

E. Shock and Vibration

1. Shock and vibration testing shall be performed. All Exterior and Equipment Room equipment, when in their fully assembled configuration, shall not be damaged, nor shall the operational performance be degraded, after subjection to vibration of 1g at 10 Hz to 500 Hz or shocks of 20g for 11 +/- 1 milliseconds in each of three mutually perpendicular planes.

2. Vibration isolation for station cabinets shall be provided to protect electronic components within the cabinets from long-term low frequency events resulting from continual train operations through the stations. Contractor shall coordinate with electronic equipment and cabinet manufacturer’s to determine proper vibration isolation hardware to meet the manufacturer’s electronic equipment environmental test specifications.

1.10 TEST AND WAIVERS

A. All environmental testing in accordance with these specifications shall require written test procedures prepared by the Contractor and approved by SEPTA. All environmental test procedures shall be submitted to the SEPTA Project Manager for review and approval before the testing commences.

B. All environmental tests shall be completed and the results submitted to the SEPTA Project Manager for approval prior to installation of equipment at any SEPTA site or sites outlined in this Specification.

1. All environmental tests shall be conducted by an independent
test facility that has been previously approved by SEPTA. The Contractor may use appropriate subcontracting to achieve environmental testing at the approved facility.

2. The Contractor may request a waiver of environmental testing for any component previously tested and certified. In such an event, fully certified technical test data shall be submitted to the SEPTA Project Manager with the waiver request. SEPTA shall retain the exclusive right to require representative environmental testing or to waive such testing after reviewing the Contractor's waiver request.

3. The Contractor may request where applicable representative, and/or sample testing to be provided. In such an event, fully certified technical test data shall be submitted to the SEPTA Project Manager with the representative or sample request. SEPTA shall retain the exclusive right to require testing or to waive such testing after reviewing the Contractor's request.

PART 2    PRODUCTS

2.01 AVPA SYSTEM TYPICAL STATION EQUIPMENT

A. Station Controller Unit (SCU)

1. The Station Control Unit for the Audio/Visual PA System at the station shall be a microprocessor controlled, modular system using passive backplane technologies. The SCU shall consist of an industrial grade PC, 2RU 19-inch rack mountable with the following minimum requirements.

   a. Pentium 4 processor, 2.4GHz.
   b. 400 MHz front side bus.
   c. 512 MB RAM.
   d. 40 GB IDE hard disk drive.
   e. Multiport (minimum of three (3) ports) Audio Output Card.
   f. Eight Input / Output data card.
   g. 10/100 Mbps Ethernet Network Interface Card (NIC).
   h. 4 USB 2.0 ports.
   i. Other ports; one (1) Parallel, two (2) Serial, one (1) PS/2
Keyboard, one (1) PS/2 Mouse, one (1) VGA.

j. Power supply with 100,000 hours MTBF.

k. Latest supported Operating System compatible with GEisys.

l. R.E. Smith model IRSCOM2A RS-232 to RS-485 protocol converter (may be mounted externally on a shelf). It is preferred that the protocol converter be mounted inside the SCU computer.

m. Keyboard, mouse and monitor. Also, provide required cabinet mount shelf hardware to support the equipment.

2. The software and hardware shall be completely compatible with the existing GENERAL ELECTRIC TRANSPORTATION SYSTEMS, GS, ACS system installed under the Key Stations Project. The following GENERAL ELECTRIC TRANSPORTATION SYSTEMS, GS, ACS software shall be utilized:

a. GEisys SCU with MSD Application software

b. Real VNC software

c. VMS Diagnostics software

3. The following summarizes the general operating parameters and functions within which the combined units shall perform in an operating unit:

a. The Station Control Unit will provide a passenger station with the facilities for selective remote control of platform speaker announcements from either the station Attendant, or Control Center operators. The Control Center operators shall have access to any station in the system. The remote control software to perform this capability shall be provided at the SCU.

b. The Station Control Unit shall incorporate priorities on a lock-out basis, which ensure a higher priority user access over a lower priority user. The priorities at the stations are as follows:

   Highest Priority: Station attendant via a microphone
   Station attendant via a message selector
   Control Center workstation
Lowest Priority: SCU automated database.

c. The system shall be capable of storing up to 500 messages that are nominally 30 seconds in duration (approximately 1,000,000 bytes of data for digitized audio messages).

d. The SCU shall include keypad (MSD) control application software.

e. The SCU shall include time synchronization software.

4. Station Control Unit features:

a. The Station Control Units shall be enclosed in existing communications room cabinets.

b. All signs shall be connected to the Station Control Units in the cabinets via opto-coupled protection devices.

c. The Station Control Unit and associated electronic equipment shall be designed to operate from -15 degrees C to +60 degrees C.

d. Power filtering and surge protection shall be provided in each cabinet power distribution panel.

B. The station shall have an MSD that allows the attendant to select stored messages and activate the selected messages at the local station. The connection and disconnection of this device to the system shall not impair the operation of the system. The Message Selection Device (MSD) must be compatible with GENERAL ELECTRIC TRANSPORTATION SYSTEMS, GS, ACS enhanced MSD software, and the GE/GENERAL ELECTRIC TRANSPORTATION SYSTEMS, GS, ACS/GENERAL ELECTRIC SCU application software. The station Message Selection Device/Keypad shall have the following requirements:

1. Message readout display showing the user entries.

2. Display user instructions for each operational step.

3. Display error messages and codes for user faults.

4. Key pad with keys labeled 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, *, #, A, B, C, and D or equivalent.
5. Limited access (keyed), weather and vandal proof enclosure

2.02 STATION AUDIO ANNOUNCEMENT EQUIPMENT (STATION MICROPHONE)

A. Station microphone shall meet the following:

1. Hand held “teardrop” style, dynamic noise canceling type designed for close talking

2. Frequency Response: 100Hz to 5kHz

3. Output Level: -60 dB with reference 0 dB

4. Impedance: 200 ohms, with ability to match 50 to 1000 ohms

5. Connector: 5 pin (DX2) DIN

6. Cable: Six wire, five conductor (one conductor shielded) coiled cord with ability to extend 7.5 feet. Durable strain relief bushing for protection against cable breakage at microphone housing.

7. Housing: Durable high-impact molded black Cycolac

8. Size: 3.375 inches high x 2.375 inches wide x 1.06 inches deep (nominal)

9. Switch: SPST spring return, factory wired normally open

B. Microphone to Line Level Preamplifier

C. Power Supply

1. The preamplifier requires a minimum of 24VDC at 25mA power source, installed within the Communications Room.

2.03 SPEAKERS

A. Cone Speakers

1. The cone speakers shall be environmentally resistant, and shall offer construction and acoustic properties for all commercial sound, intercom and protective signaling systems. Each speaker shall have a frequency response from 50 to 15,000 Hz and a power rating of 15 Watts minimum.

2. The cone speaker provided shall be capable of being recessed or surface mounted in enclosures as shown on the
Contract Drawings.

3. Each speaker shall include multi-tap matching transformer integral to the speaker unit. Speaker power shall be adjusted as required. Wiring terminals for amplifier output shall be fully enclosed, and a vandal-resistant adapter cover shall be provided with a connector for flexible conduit.

B. Horn Speakers

1. The platform horn speaker shall be a re-entrant, single-fold horn, audible signal appliance, weatherproof construction, and having a power capacity of 15 watts RMS. The frequency response shall be flat (±3 dB) between 275 and 14,000 Hz, providing a sound level of 114 dBm at four feet on axis with 15 Watts input power.

2. Each speaker shall include a multi-tap matching transformer integral to the speaker unit. Wiring terminals for amplifier output shall be fully enclosed, and a vandal-resistant adapter cover shall be provided with a connector for flexible conduit.

3. The speaker shall be mounted using the wraparound steel supporting bracket and tamper proof hardware.

2.04 VARIABLE MESSAGE SIGNS (VMS)

A. All Signs

1. Each sign shall be a high-resolution commercially available microprocessor based LED unit consisting of the housing and the interior electronics.

2. All signs and/or sign enclosures shall have sunlight shielding as required. Sunlight shielding shall be used as needed in indoor locations to reduce glare on the Variable Message Signs from lighting fixtures.

3. All signs shall have ambient light sensing which automatically alters the intensity of the display. The ambient light sensing shall be automatically accomplished via electronic means. The use of manual adjustable controls shall not be permitted.

4. Each sign shall be capable of communicating with a host SCU for simultaneous operation with the audio message system. Programmable display effects shall include static, pause, flash, blink, scroll, center, up, down, and jump. The speed of the effects shall be electronically adjustable. Characters to be
displayed shall include the entire 128 ASCII character set along with the selected internal characters, and shall support pixel-based graphics.

5. The signs shall have the minimum memory to contain 80 messages of 80 characters for each message including the display attributes. Multiple fonts shall be available including, but not limited to, ADA compliant aspect ratios, narrow, bold, and wide characteristics.

6. The signs shall conform to FCC Part 15 Class A limits for conducted and radiated emissions of electromagnetic interference.

7. All connectors shall meet minimum UL 94VO flammability requirements.

8. All signs shall be accessible for servicing and maintenance and have vandal-proof fasteners and/or locks. For service and maintenance, access to the sign electronics shall be provided by opening the front lid and allow for the electronics to be removed. It shall not be necessary to remove the entire sign and housing for maintenance.

9. All signs shall be designed for a minimum life of twenty (20) years.

10. Communications with each sign shall be by means of fault tolerant, noise resistant, protocol (i.e. RS-485). Each sign shall have the ability to be uniquely addressed, or addressed by groups. There shall be a minimum of 10,000 different addressable groups.

11. Each sign shall include a disconnect for removing AC power for maintenance purposes. Line filtering shall be part of the design to minimize faults due to power line transients. Surge protection shall be built in to each sign.

12. All signs shall provide diagnostic information to the station SCU upon power up when requested and if a failure condition is detected.

13. All signs shall provide positive feedback on every command or request received from the SCU.

14. All signs shall have a real time clock that can be set via the sign network. The clock shall be accurate to within 1 second per month. The time and day shall be maintained by each
sign. Time and day data shall be maintained during power loss.

15. The MTBF of each sign shall be at least 100,000 hours of operation.

16. The LED signs shall have a viewing angle of at least 30 degrees (minimum) off center. The determination of viewing angle shall be when the angled LED illumination intensity is 50 percent of the LED illumination intensity measured at center.

17. The LED panel assemblies shall be modular, interchangeable without re-alignment, and removable.

18. All signs shall operate in the temperature range from –20 degrees C to +50 degrees C to 95 percent, non-condensing. Heating and cooling shall be provided if required to operate in this range. The sign faces shall remain clear and readable in all operating temperature ranges and humidity. Any and all temperature control subsystems shall be thermostatically controlled. All sign enclosures shall be as specified in Article 2.04-C.

   a. Heaters: Minimum of one (1) 50W strip heater

   b. Fans: Minimum of one (1) 30 CFM box fan (internal) controlled by 90 degree Fahrenheit thermostat.

19. The dimensions of the LED signs are specified on the Contract Drawings.

20. Sign types at each installation are specified on the Contract Drawings. The sign types shown on the Contract Drawings include the following configurations:

   a. Single sided, single line, red LED.

   b. Double sided, single line, red LED.

B. Single Line Signs (Single Sided and Double Sided)

1. All single line signs shall have 18 characters per line minimum represented by the ADA compliant font with using 96 millimeters character heights minimum. All sign text letters shall be upper case. All single line signs shall be composed of an equally spaced monolithic dot matrix LEDs. The single line sign shall be composed of 5 millimeters minimum sized LEDs.
with a centered spacing of 6 millimeters maximum. All LEDs shall have individual sun shade covers. The single line signs shall be composed of a minimum LED pixel matrix of 16 LEDs in height by 256 LEDs in width. The single line signs shall be sun light readable and have a minimum 600 candela per meter squared brightness, designed for outdoor operation. The single line LED pixels shall be totally viewable while in the enclosures. The same style, size, model, and type of sign for all single and double sided signs shall be used at all locations.

2. All single line, single color signs shall be red LEDs on a matte black background. Pixel spacing shall be 0.235-inch pitch. A minimum of one (1) red LED per pixel shall be provided.

3. All signs shall provide their own temperature control. All signs shall be convection cooled. The sign electronics shall sense any temperature faults (over-heating and under-heating) and report to the Station Control Unit. The sign electronics shall be fault protected so that temperature conditions do not damage any sign components.

4. All sign input power requirements shall be 120VAC, 60 Hz, single phase 3 amps for single line single sided (SLSS) signs and 6 amps for single line double sided (SLDS) signs. Signs shall be protected by internal circuit breaker and surge suppressor from the nearest panelboard feeders.

5. The VMS shall utilize power supplies that are internal to the VMS enclosure.

C. Sign housing/Enclosure

1. Each new sign housing shall be modular, vandal resistant, water tight and corrosion resistant. All sign components, including but not limited to, LED grids, electronics, power supplies, sensors, etc., shall be fastened and enclosed in NEMA 4X certified housings as an integrated unit.

2. All signs shall be designed and constructed so as to present a clean neat appearance. Poor workmanship shall be cause for rejection of the sign.

3. Any and all cable attachments to the sign and/or sign housing shall have the cables securely clamped without the use of adhesives.

4. The sign housing, poles, mounting brackets, and cabling shall be designed to withstand winds of up to 193 kilometers per
hour (120 miles per hour) without permanent deformation or other damages. Performance of the sign shall not be impaired by wind or weather. The sign mounting shall support a minimum of 227 kilograms (500 lbs), including signs mounted on poles, canopies, ceilings and walls.

5. The sign electronics shall have over/under voltage and surge protection for both data and power supply lines. The electronics shall be isolated from the enclosure and hardware. All sign enclosures shall have internal circuit protection and breaker systems with a reset device. All electronics enclosed in the sign shall be connected to the enclosed sign power block for circuit protection.

6. All electronic components, except printed circuit boards, shall be commercially available, easily accessible, replaceable and individually removable using conventional electronics repair methods.

7. All external screws, nuts, and locking washers shall be corrosion resistant and vandal resistant. No self-tapping screws shall be used on the exterior of the signs. All external parts and mounting brackets shall be made of corrosion resistant materials and shall be moisture resistant. Dissimilar metals shall be separated by an inert dielectric material.

8. The sign housings shall have a minimum number of seams. All exterior seams and joints shall be sealed to form a rain-tight enclosure.

9. The sign housing exteriors shall be stainless steel (Type 304) or aluminum. The Contractor shall provide a sample housing with the sign display face for SEPTA approval before fabrication and installation.

10. The sign display faces shall be polycarbonate Lexan MR5, gray 713, with an 8 millimeter minimum thickness, or approved equivalent. The faces shall be easily cleanable, scratch proof, and vandal resistant.

11. All areas of the sign faces not used in the sign display shall be made opaque, matte black.

12. All sign enclosures shall have sun shielding covers and faces as required.
D. Sign Software

1. Sign communications software shall be “Hi-Tech Complay” or SEPTA approved equivalent VMS control and diagnostics software. All sign software updates shall be approved by SEPTA before installation is allowed.

2. All sign software, configuration data and memory data shall be updated electronically. Component exchanging shall not be permitted.

3. The sign shall provide the software version number on demand.

4. All system and component software, including, but not limited to, LED signs, PA Systems, Station Control Units, AVPA workstations and Servers, shall be a tested, released version only. No software shall be permitted in any part of the system that is not a controlled, released version. All like equipment shall have the same versions of software. All software components shall be submitted and turned over to the SEPTA Project Manager at the completion of the Project.

5. Any updated versions of the system and component software shall be backwards compatible with the other system and component software.

6. Upon power up or reset, the sign shall display all version numbers, date, time, communications configuration data, and status data.

7. Diagnostics shall include test patterns, memory configuration, alarms, faults, relay logic and LED defect detection.

8. Sign message organization shall show train arrival frequency information, current time, and service messages.

2.05 Cabling and Connections

A. Power and signal cables shall be installed in separate raceways.

B. The equipment shall be wired such that 20 Amp (maximum) branch circuits are required for power.

C. Provide system wiring materials as follows:

1. Signal control and data cables shall be 24 AWG, stranded, twisted pair, 300 volt, shielded cable.
2. Speaker Wire: 1 TP, 16 AWG, shielded; plenum insulation, aluminum polyester shield, chrome sunlight resistant jacket, temperature rating: 105 degrees Celsius, and voltage rating: 300 volts.

3. SCU Link: 2 TP, 22 AWG, shielded; Polypropylene insulation, twisted pairs, each pair under aluminum polyester shield, pairs cabled on common axis to reduce diameter, jacketed, NEC CM temperature rating: 60 degrees Celsius, and voltage rating: 300 volts.

4. Microphone: 2 TP, 16 AWG, shielded; polypropylene insulation, twisted pairs, each under aluminum polyester shield, pairs cabled on common axis to reduce diameter, jacket, NEC CM temperature rating: 60 degree Celsius, and voltage rating: 300 volts.

5. AC wiring to all devices shall be grounded via the identified grounding conductor and shall not utilize the conduits or other raceway. The Contractor shall produce wiring diagrams showing the circuit breaker numbers, wire gauges, wire paths and connections.

6. All control and data cables shall have tinned copper conductors.

D. Variations of the above listed cable may be used upon approval by SEPTA.

E. Furnish all equipment, hardware, accessories, terminal blocks, cabinets, conduits, raceway, cable trays, cables, and wire required for mechanical and electrical installation of the Audio/Visual PA Systems as herein defined.

2.06 DATA CENTER HARDWARE AND SOFTWARE

A. The Contractor shall provide the following hardware and software items:

1. Two (2) IBM x3550 or most current version rack-mount 1U series servers with the following minimum requirements:

   a. 3 GHz processor

   b. 2 Gb RAM

   c. Dual 36 Gb hot-swappable hard drives configured in RAID 1
d. DVD-RW drive

e. Dual redundant power supplies

f. Remote Supervisor Adapter

g. 4-year IBM on-site repair service 9x5 with 4-hour response

2. Software

a. Microsoft Windows Server 2003 or most current Enterprise license for each server

b. NetBackup Client, Windows, Protect Server, v6.x license for each server

c. NetBackup Client 1-year 7x24 support for each server.

d. Microsoft Operations Management License (OML) for each server.

e. Install and configure any GEisys server applications (i.e., Display manager, Event manager, etc) required for a fully functional stand-alone RailEdge system.

2.07 MAINTENANCE AND TEST EQUIPMENT

A. The Contractor shall provide all required test equipment and/or software required for system diagnostics and analysis.

2.08 SPARE EQUIPMENT

A. All spare equipment not used shall become the property of SEPTA.

B. Spare equipment, as identified in Section 01750, shall be provided by the Contractor. The Contractor shall use this spare equipment with the SEPTA Project Manager’s approval after testing the determining that existing equipment is not operational. The Contractor shall provide equipment test reports to the SEPTA Project manager for all equipment tested.

PART 3 EXECUTION

3.01 GENERAL

A. Install all system equipment in accordance with all Contract requirements, with approved Contractor Drawings and consistent
with good commercial practices.

### 3.02 EQUIPMENT LOCATIONS

A. The equipment shall be provided and installed as detailed herein and on the Contract Drawings.

### 3.03 COORDINATION

A. All the Work included in this section shall be coordinated with the current operation of the existing system(s).

B. The Contractor shall coordinate the finish required for all fixtures, plates, panels, grilles, and enclosures supplied as part of this section with the SEPTA Project Manager.

C. The Contractor shall be responsible for coordination with the Millworker for any AVPA items to be built or mounted into millwork.

D. Prior to installing the SCUs within the station Communications Rooms, the Contractor shall coordinate with the SEPTA Project Manager and deliver the SCUs to SEPTA for initial software configuration and setup. Upon completion of the setup by SEPTA, the SCUs will be returned to the Contractor for installation.

### 3.04 FABRICATION AND INSTALLATION

A. All installation practices shall be in accordance with, but not limited to, this section and the Contract Drawings. Installation shall be performed in accordance with the applicable standards, requirements, and recommendations of all Authorities Having Jurisdiction.

B. If, in the opinion of the Contractor, an installation practice is desired or required, which is contrary to this section or Contract Drawings, a written request for modification shall be submitted to the SEPTA Project Manager. Modifications shall not commence without written approval from the SEPTA Project Manager.

C. Provide intelligible, permanent identification on or adjacent to all patching jacks, connectors, receptacles, terminal blocks, meters, indicators, switches, equalizers, mixers, amplifiers, etc. The identification shall clearly indicate the function, or circuit. Refer to Section 16075, Electrical Identification.

D. The Contractor shall take such precautions as are necessary to guard against electromagnetic and electrostatic hum, to supply adequate ventilation, and to install the equipment so as to provide
maximum safety to SEPTA personnel and the public.

E. All wire and cable shall be continuous and splice free over the entire length of the run between designated connections or terminations, unless otherwise indicated on the Contract Drawings.

3.05 COMMUNICATION ROOM INSTALLATION

A. Furnish and install equipment in the Communication Cabinet at the Levittown Station as indicated on the Contract Drawings. Connect all appropriate station wiring to the rack-mounted interface terminal panel, connect interface wiring to the proper wiring-frame terminals and, after testing the Audio/Visual PA System installations, complete the cross-connects on the wiring frame to the assigned terminals.

1. Final connections to the existing station Public Address System power amplification system will be completed by SEPTA.

B. Furnish and install 120VAC power conduit and cables within the Communications Cabinet to the Station Control Units, as required.

C. Furnish and install 120VAC power conduit and cables within the Electrical/Communications Cabinet for the operation of the Variable Message Signs as specified herein.

3.06 STATION INSTALLATION

A. Furnish and install speakers, speaker baffles, microphones, control switches, and all wiring and wiring devices (sub-panels) required to complete the Levittown Station installation of the Audio/Visual PA System. Cable distribution to the various station and platform speakers shall utilize conduit and cable tray raceway provided as described in the Contract Drawings. Shield continuity shall be maintained throughout each run and the shield grounding shall be accomplished only at the communication room end of each shielded cable run.

B. Station Speakers

1. Ensure that the polarization of all Audio/Visual PA System speakers is maintained throughout the station to insure that no distortion is introduced into any Audio/Visual PA System from erroneous speaker phasing. Initial speaker transformer taps shall be connected to provide adequate audio coverage throughout the station area.
C. Platform Speakers

1. Mount all platform speakers at locations shown in the Contract Drawings and/or as directed by the SEPTA Project Manager. All speaker assembly mounts and hardware shall be per speaker manufacturer’s recommendations.

D. Minimum Clearances

1. All station VMS and speakers shall be installed to provide a minimum of 80 inches of unobstructed height over occupied walking areas.

3.07 INSTALLATION AT CONTROL CENTER AT 1234 MARKET STREET

A. Installation of AVPA equipment software modifications shall be commenced upon completion of all installation work at the Levittown station within the scope of this Contract.

B. Prior to the commencement of AVPA equipment installations at the Levittown Station within the scope of this Contract, the server equipment hardware and software shall be installed, configured, and tested by the Contractor.

C. Coordinate the actual installation dates and timeframes for the Control Center with the SEPTA Project Manager.

3.08 GROUNDING

A. Provide independent signal circuit grounding as recommended by the equipment manufacturer, and in accordance with EIA/TIA J-STD-607.

B. Provide grounding to equipment enclosures as required by the NEC and in accordance with Section 16060.

3.09 INSTALLATION INSPECTION

A. Following completion of the installation of all equipment at a site, inspect all equipment wiring to verify that all mechanical connections are made and properly secured, all hardware is installed in its proper location, and all wiring is properly terminated. This inspection shall include conductor and shield continuity and isolation verification of all installation wiring.

3.10 TESTING REQUIREMENTS

A. Factory Testing
1. All Audio/Visual PA System equipment and materials shall be tested at the manufacturing location using the production inspection and testing procedures in normal use by the Manufacturer. Certification of the testing shall be provided to the SEPTA Project Manager.

2. Rack-mounted Equipment

   a. Factory testing of all rack-mounted components of the Audio/Visual PA System shall be completed at the facility of the Manufacturer or of the Contractor. This factory testing shall include functional testing of each item of rack-mounted equipment to insure its proper operation in the system as well as testing the assembled unit as a system to insure that each component functions properly in relationship to all other components as required by this Specification.

B. Installation Testing

   1. Test the rack-mounted Audio/Visual PA System equipment under power following approval of the installation inspection by the SEPTA Project Manager. Installation testing shall demonstrate the full functional capability of the equipment.

C. System Testing

   1. Test the Audio/Visual PA System at the Levittown Station once installation is complete and SEPTA has approved the inspection certification. System testing shall address at minimum:

      a. Functional testing of each equipment item installed.

      b. Balancing and adjusting speaker levels throughout the system to demonstrate sound levels of 77 dB, ±3 dB, at ear level (five feet above floor level) immediately beneath each cone speaker and eight feet in front of each horn speaker at the station.

      c. Distortion check between each adjacent pair of speakers to demonstrate speaker polarization is correct.

      d. Message quality at four locations in each speaker chain, using inputs from each of the available sources of announcements.

      e. Demonstration that audio level at ear level shall not
exceed 95 dB at any point in the station with the system control settings at operational maximum output.

g. Demonstration of all system control functions available at the station.

D. Acceptance Testing

1. Acceptance testing of the complete Audio/Visual PA System shall follow completion of all contracted installation and system testing, including station and Control Center based system tests. Acceptance testing shall consist of exercising the overall Audio/Visual PA System from the Control Center as well as from local control points to verify all status and alarm indications, operator and sign displays and priority definitions are functioning correctly at the Levittown Station to verify the operation of the entire system.

2. The test guidelines are required for the new and existing equipment.

a. Test the equipment after installation to determine if it operates when its assigned code(s) are transmitted from the Control Center using existing DTMF signaling system, while rejecting all codes other than the assigned code(s). The Audio/Visual PA System shall respond to each of its codes by sending out its respective verification code on the uplink. The system shall broadcast audio upon receiving the push-to-talk code. The announcement sidetone shall be sent back to the up-link upon receiving its respective sidetone amplifier code.

b. Demonstrate that, upon receiving the turnoff code, the Audio/Visual PA System returns to its normal standby status. The system will also operate locally when the output audio and push-to-talk activation is made from an external microphone and pre-amplifier wired to the microphone input port. An operational test of the Audio/Visual PA System priority shall be made to demonstrate control priorities.

3. Acceptance testing shall be performed over a thirty (30) day period. The Contractor shall provide a detailed test plan for approval by SEPTA.
E. Test Report

1. Provide test support upon request by the SEPTA Project Manager to assist in additional testing of the Audio/Visual PA System or equipment after its acceptance by SEPTA.

F. All final field testing shall be witnessed and approved by SEPTA Project Management personnel.

3.11 TRAINING

A. The Contractor shall supply training for SEPTA designated personnel in all aspects of operation and maintenance of the communications system. Training shall be provided in accordance with Section 01820, Demonstration and Training.

B. The Contractor shall provide maintenance and operations training prior to equipment being made fully operational in the field.

C. Training shall be provided by personnel thoroughly familiar with the equipment operation. This may be the Contractor's personnel, equipment manufacturer's representatives, or a combination of the two. A complete course outline and summary of the experience and qualifications of the instructional personnel shall be submitted to the SEPTA Project Manager for approval prior to the start of training.

D. Recommended test equipment, systems components, literature and drawings for the classes shall be furnished by the Contractor. At the conclusion of classes, all items furnished, which are not currently owned by SEPTA, shall become the property of SEPTA.

E. Training shall be provided in three (3) separate sessions for each type of training. Training sessions shall be video taped and ten (10) copies of the tapes supplied. Each training session shall be between two (2) and four (4) days.

3.12 OPERATION AND MAINTENANCE DOCUMENTATION

A. Refer to Section 01830, Operations and Maintenance Data.

B. The Contractor shall provide the following manuals:

1. Operating/user manuals - ten (10).


3. All OEM supplied manuals - ten (10).
4. Administrator’s manuals – ten (10)

3.13 ENVIRONMENTAL TEST PROCEDURES

A. The environmental requirements described herein shall be in effect for all components unless specifically excluded by other specification sheets of this procurement document.

B. All test procedures related to environmental testing for Temperature, Rain, Humidity, Salt Fog, Dust, Vibration and Shock which are prepared by the Contractor for SEPTA approval shall be formulated in accordance with the requirements of MIL-STD-810(E). Testing for electrostatic discharge (ESD) shall be formulated in accordance with IEC 61000-4. No exceptions shall be made to this requirement without prior written approval by the SEPTA Project Manager.

C. System components shall operate normally under various environmental test conditions as defined in MIL-STD-810(E), Environmental Test Methods. Methods and procedures to be used shall include:

1. Test Method 501.3 High Temperature:
   a. Procedure II - Operation, Category A2, Induced, (High = 63 degrees C)

2. Design Method 501.3 High Temperature:
   a. Procedure I - Storage, Category A2, Induced, (High = 63 degrees C)

3. Test Method 502.3 Low Temperature:
   a. Procedure II - Operation, Category C1, Induced, (Low = -25 degrees C)

4. Design Method 503.3 Temperature Shock:
   a. Procedure I - Categories A2 and C1, Induced;

5. Design Method 505.3 Solar Radiation:
   a. Procedure I - Basic Hot

6. Test Method 506.3 Rain:
   a. Procedure I - Blowing Rain
b. Procedure II - Drip

7. Test Method 507.3 Humidity:
   a. Procedure I - Natural High Humidity

8. Test Method 509.3 Salt Fog:
   a. Procedure I - Aggravated Screening

9. Test Method 510.3 Sand and Dust:
   a. Procedure I - Blowing Dust

10. Test Method 514.4 Vibration:
    a. Procedure I - Category 1, Basic Transport, Transportation Induced
    b. Procedure I - Category 10, Minimum Integrity Test, Application Induced
    c. Procedure III - Category 3, Loose Transport, Transportation Induced

11. Test Method 516.4 Shock:
    a. Procedure I - Functional Shock
    b. Procedure VI - Bench handling

D. System components shall operate normally under various environmental test conditions as defined in IEC 61000-4, Electromagnetic Compatibility.

1. Test Part 2: Electrostatic Discharge Requirements
   a. Laboratory Test  (This test may be waived if previous laboratory test data exist and are submitted for review with waiver request.)
   b. Post Installation Test

E. Refer to Exhibit 16730-1, Environmental Requirements, on the following page.
Exhibit 16730-1

ENVIRONMENTAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Equipment Room</th>
<th>Exterior Equipment</th>
<th>Interior Equipment</th>
<th>Test Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-25°C to 63°C</td>
<td>-25°C to 63°C</td>
<td>MIL-STD-810(E)</td>
</tr>
<tr>
<td>Humidity</td>
<td>5% to 95% (Note 1)</td>
<td>5% to 95% (Note 1)</td>
<td>20% to 80% 507.3, I (Note 1) Interior: Design Only</td>
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<tr>
<td>Rain &amp; Tightness</td>
<td>Drip Rain</td>
<td>Blowing Rain</td>
<td>No 506.3, I, Blowing Rain 506.3, II, Drip</td>
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<tr>
<td>Corrosion &amp; Contaminants</td>
<td>Yes Yes No</td>
<td>509.3, I, Salt Fog-Ag Screen 510.3, I, Blowing Dust</td>
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<tr>
<td>Voltage Input</td>
<td>+/-10%</td>
<td>+/-10%</td>
<td>+/-10% Local Test</td>
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<tr>
<td>RF/Elec Noise Interference</td>
<td>Yes Yes Yes</td>
<td>IEC 61000-4 Interior: Design Only</td>
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<tr>
<td>Shock (20g)</td>
<td>11msec</td>
<td>11msec</td>
<td>No 516.4, I, Functional 516.4, VI, Bench Handling</td>
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<tr>
<td>Vibration (1g)</td>
<td>10 to 500Hz</td>
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<td>No 514.4, I, Cat 1, Basic X-port 514.4, I, Cat 10, Min Integ 514.4, III, Cat 3, Loose Tans</td>
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<tr>
<td>Dry Storage Variations</td>
<td>-25°C to 63°C</td>
<td>-25°C to 63°C</td>
<td>-25°C to 63°C 501.3, I, A2 All: Design Only</td>
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</table>

Note 1: Non-condensing

END OF SECTION
SECTION 16880
ELECTRIC RESISTANCE HEATING

PART 1    GENERAL

1.01    DESCRIPTION

A. This Section describes the electric unit heaters with integral thermostats in sizes and capacities as specified and shown.

1.02    RELATED SECTIONS

A. Section 16050 – Basic Electrical Materials and Methods
B. Section 16060 – Grounding and Bonding
C. Section 16070 – Hangers and Supports
D. Section 16075 – Electrical Identification
E. Section 16120 – Conductors and Cables
F. Section 16130 – Raceways and Boxes
G. Section 16150 – Wiring Connections
H. Section 16400 – Low-Voltage Distribution
I. Section 16970 – Testing and Commissioning

1.03    SUBMITTALS

A. Provide the following information with each shop drawing:

   1. Product Data: Provide manufacturer’s catalog information showing dimensions, ratings, materials, fabrication details, finishes, contacts, pushbuttons, timed relays, timed relay switches, indicator lights, accessories and performance data.

   2. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.
1.04 QUALITY ASSURANCE

A. Perform work in accordance with the Township of Levittown Standards.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

D. Perform Work in accordance with NECA Standard of Installation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Protect from construction traffic, dirt, water, chemical, and mechanical damage, by storing in original packaging.

1.06 OPERATIONAL AND MAINTENANCE DATA

A. Operation Data: Include instructions for safe operating procedures.

B. Maintenance Data: Include complete replacement parts list and instructions for replacement parts and troubleshooting diagnostics.

C. Include recommended cleaning methods and cleaning materials for interior parts and exterior finishes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:

1. The Trane Company: Series UHXA.

2. INDEECO.

3. Markel.

2.02 ELECTRIC UNIT HEATERS

A. Explosion-proof electric Unit heater: Provide unit heaters meeting UL Standard 165C, Factory Mutual approved for: Class 1,
Divisions 1 and 2, Groups C and D; Class II, Divisions 1 and 2, Groups F and G. Unit heater shall be of the forced air design and meets the capacities indicated on the drawings.

B. Input Voltage: 208 volts, 60 Hz, single phase.

C. Heating Element: Heat exchanger of the liquid-to-air design with copper tube core and integral aluminum fins. Non-toxic, inhibited, glycol type of heat transfer fluid providing freeze protection. Exchanger includes a pressure relief valve and three, low watt density, immersion type copper sheathed heating elements hermetically sealed into the core.

D. Cabinet: Heat exchanger and fan enclosed in an epoxy-coated, 14 gauge steel corrosion resistant cabinet. Individually adjustable outlet louvers have minimum opening safety stops.

E. Controls: Unit shall have dual automatic reset thermal protection cutouts, controlling magnetic contactor and 24 volt control circuit transformer house in a NEMA 7, cast aluminum enclosure.

F. Provide terminal blocks for power and control wiring connections.

G. Motor and Fan: Aluminum fan blade directly mounted to the fan motor. Fan motor shall include permanently lubricated ball bearings and built-in thermal overload protection. Motor shall operate at line voltage and prewired to the control enclosure.

2.03 ACCESSORIES

A. Unit shall be provided with wall accessory mounting kit.

B. Provide an adjustable built-in capillary-type thermostat, UL Listed for Classes I, II, Groups C, D, E, F and G.

C. Unit shall be provided with factory installed and wired manual reset thermal cutout for over temperature protection.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

B. Verify that required utilities are available, in proper location, and ready for use.
C. Beginning of installation means installer accepts existing conditions.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate each unit in position indicated on contract drawings.

C. Install unit with sufficient clearance from adjacent construction, piping, and other obstructions to allow access for service and maintenance.

3.03 FIELD QUALITY CONTROL

A. Verify operation of each electric heating unit by measuring input voltage and current simultaneously for period of ten minutes of continuous operation.

3.04 DEMONSTRATION

A. Demonstrate operation for a period of not less than 60 minutes.

B. Demonstrate location of circuit breakers and switches serving electric heating branch circuits, and location and setting procedures for thermostats and other heating controls.

END OF SECTION
SECTION 16970
TESTING AND COMMISSIONING

PART 1   GENERAL

1.01   DESCRIPTION

A. This specification section, along with the Contract Drawings, is intended to cover testing and commissioning requirements applicable to all electrical work involved with the project.

B. Provide materials, labor, tools, equipment, supervision, and all appurtenances as required for complete testing and commissioning.

1.02   RELATED SECTIONS

A. Section 16010 – Electrical Requirements
B. Section 16060 – Grounding and Bonding
C. Section 16120 – Conductors and Cables
D. Section 16140 – Wiring Devices
E. Section 16410 – Enclosed Switches and Circuit Breakers
F. Section 16442 – Panelboards
G. Section 16510 – Interior Luminaires
H. Section 16525 – Site Lighting
I. Section 16530 – Emergency Lighting
J. Section 16730 – AVPA Systems for Heavy Rail
K. Section 16880 – Electric Resistance Heating

1.03   SUBMITTALS

A. Submit Testing and Commissioning report.

1.04   QUALITY ASSURANCE

B. National Electrical Manufacturers Association (NEMA).

C. American National Standard Institute (ANSI).


E. National Electrical Contractors Association (NECA) - Standard of Installation.


PART 2 PRODUCTS

2.01 GENERAL

A. Provide all instruments required for testing.

B. Test and calibrate all instruments for accuracy prior to use.

PART 3 EXECUTION

3.01 TESTS

A. All work shall be tested regularly during its progress. SEPTA shall have power to test any portion of work at any time, and all labor and material shall be furnished as necessary to assist in making such tests. Foreman in charge of work shall give his personal attention, together with any other assistance required, in order to investigate any portion of work. The following tests shall be performed: Insulation resistance on main feeders, load balancing in panelboards, correct rotation of motors, thermographic inspection, GFCI receptacle operational test and ground resistance.

B. Perform all tests in the presence of SEPTA representatives. All fuses and circuit breakers are to be in place, splices made and all equipment connected at the time tests are made. Furnish labor, materials and instruments necessary to conduct the tests.

C. On completion, the work is to be inspected and must satisfactorily pass tests against short circuits and grounds.

D. Motor rotation shall be checked and corrected if necessary.

E. The Electrical Contractor shall be present during the test operation of all mechanical equipment to which electrical connections have been made.
F. Contractor shall demonstrate the proper operation of all fire alarm devices.

3.02 RESPONSIBILITY DURING TESTS

A. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when SEPTA formally take over the operation thereof.

3.03 FAILURE OF TESTS

A. Any defects in the equipment, or deviations from the guarantees or requirements of the specifications, shall be promptly corrected by the Contractor by replacements or otherwise. If the Contractor fails to correct any defects or deviations, or if the replaced equipment when tested shall fail again to meet the guarantees or specified requirements, SEPTA notwithstanding there having made partial payment for work and materials, may reject the equipment and order the Contractor to remove it from the premises at the Contractor’s expense.

END OF SECTION
APPENDIX A

SITE BORING LOGS AND LABORATORY TEST RESULTS
Particle Size Distribution Report

<table>
<thead>
<tr>
<th>PERCENT FINER</th>
<th>GRAIN SIZE - mm</th>
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<tr>
<td>90</td>
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<th>% FINES</th>
</tr>
</thead>
<tbody>
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<td>% FINE</td>
<td>% CRS.</td>
<td>% MEDIUM</td>
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<th>C_{u}</th>
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</table>

MATERIAL DESCRIPTION

- Brown silty SAND

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Client</th>
<th>Project</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| 048583.A100 | SEPTA  | SEPTA Levittown Station | Date: February 25, 2008  
Nat. Water Content: 17.6%  
Tested By: DFP |
| Source | Sample No. | Elev./Depth |
| Boring No.: P-2 | S-2,3 | 2.5'-5.5' |
### Particle Size Distribution Report

#### % + 3" Percentage

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<th>% SAND</th>
<th>% FINES</th>
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#### LL and PL Values

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#### Project Information

- **Project No.:** 048583.A1001
- **Client:** SEPTA
- **Project:** SEPTA Levittown Station
- **Source:** Boring No.: P-4
- **Sample No.:** S-1
- **Elev./Depth:** 1'-2.5'
- **Date:** February 25, 2008
- **Nat. Water Content:** 9.1%
- **Tested By:** DFP

**Remarks:**

- Brown silty SAND
- SM
- A-2-4(0)

**Scale:** USCS
## Particle Size Distribution Report

### Table: Particle Size Distribution

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</table>

|        | LL       | PL     | D₈₅   | D₆₀   | D₅₀   | D₃₀   | D₁₅   | D₁₀   | Cc    | Cu    |
|        | 18       | NP     | 0.210 | 0.109 |

### Material Description

- Brown sandy SILT

### Project Details

- **Project No.**: 048583.A100.
- **Client**: SEPTA
- **Project**: SEPTA Levittown Station
- **Source**: Boring No.: P-6
- **Sample No.**: S-3,4
- **Elev./Depth**: 4’-7”

### Remarks

- **Date**: February 25, 2008
- **Nat. Water Content**: 16.1%
- **Tested By**: DFP
Particle Size Distribution Report

PERCENT FINER

GRAIN SIZE - mm

<table>
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<tr>
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<th>% GRAVEL</th>
<th>% SAND</th>
<th>% FINES</th>
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</table>

MATERIAL DESCRIPTION

Brown silty SAND

Project No. 048583.A100
Client: SEPTA
Project: SEPTA Levittown Station

Source: Boring No.: P-7   Sample No.: S-3   Elev./Depth: 4'-5.5'

Remarks:
- Date: February 25, 2008
- Nat. Water Content: 14.1%

Tested By: DFP

Scale: USCS
### Project No. 048583.A100
### Client: SEPTA
### Project: SEPTA Levittown Station

**Source:** Boring No.: P-8  
**Sample No.:** S-3  
**Elev./Depth:** 2.5’-4’

**Date:** February 25, 2008  
**Nat. Water Content:** 17.5%

**Remarks:**
- Tested By: DFP

---

### Material Description

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<thead>
<tr>
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<th>% Gravel</th>
<th>% Sand</th>
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- **LL**: 20  
- **NP**: 0.178

**MATERIAL DESCRIPTION**
- Brown sandy SILT

**Scale:** USCS

**Scale:** USCS

---

### Graph

- **Particle Size Distribution Report**
- **Grain Size - mm**
  - 0.001
  - 0.005
  - 0.01
  - 0.02
  - 0.04
  - 0.08
  - 0.1
  - 0.2
  - 0.4
  - 1
  - 2
  - 4
  - 10
  - 20
  - 50
  - 100
  - 200

- **Percent Finer**
  - 0
  - 10
  - 20
  - 30
  - 40
  - 50
  - 60
  - 70
  - 80
  - 90
  - 100

**Remarks:**
- A-4(0) ML Brown sandy SILT

**Remarks:**
- AASHTO USCS MATERIAL DESCRIPTION
  - D10: 0.178
  - D30: 31.5
  - D50: 66.8
Particle Size Distribution Report

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MATERIAL DESCRIPTION

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- **Brown SILT**

**Project No.** 048583.A100

**Client:** SEPTA

**Project:** SEPTA Levittown Station

**Source:** Boring No: ST-1  **Sample No.:** S-5,6  **Elev./Depth:** 7'-10'

**Remarks:**
- Date: February 25, 2008
- Nat. Water Content: 18.5%
- Tested By: DFP

**Scale:** USCS
Particle Size Distribution Report

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MATERIAL DESCRIPTION

- Brown well-graded GRAVEL with silt and sand

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<tr>
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| Remarks:    | Date: February 25, 2008  
Nat. Water Content: 7.6%
Tested By: DFP |
| Source:     | Boring No: ST-1  
Sample No.: S-12  
Elev./Depth: 17.5'-18.5' |

Scale: USCS

Gannett Fleming
ENGINEERS AND PLANNERS
Particle Size Distribution Report

<table>
<thead>
<tr>
<th>% + 3&quot;</th>
<th>% GRAVEL</th>
<th>% SAND</th>
<th>% FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRS.</td>
<td>FINE</td>
<td>CRS.</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LL</th>
<th>PL</th>
<th>D85</th>
<th>D60</th>
<th>D50</th>
<th>D30</th>
<th>D15</th>
<th>D10</th>
<th>Cc</th>
<th>Cu</th>
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</thead>
<tbody>
<tr>
<td>17</td>
<td>NP</td>
<td>0.205</td>
<td>0.0936</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

MATERIAL DESCRIPTION

- Brown sandy SILT

Project No.: 048583.A100.0006
Client: SEPTA
Project: SEPTA Levittown Station

- Source: Boring No.: ST-2
- Sample No.: S-4
- Elev./Depth: 4.5' - 6'

Remarks:
- Date: February 25, 2008
- Nat. Water Content: 18.7%
- Tested By: DFP

Scale: USCS
**Particle Size Distribution Report**

- **% + 3"**
  - % GRAVEL
    - CRS.
    - FINE
  - % SAND
    - CRS.
    - MEDIUM
    - FINE
  - % FINES
    - SILT
    - CLAY
- **LL**
- **PL**
- **D_{85}**
- **D_{60}**
- **D_{50}**
- **D_{30}**
- **D_{15}**
- **D_{10}**
- **C_{c}**
- **C_{u}**
- **MATERIAL DESCRIPTION**
- **USCS**
- **AASHTO**

- **Project No.** 048583.A100
- **Client:** SEPTA
- **Project:** SEPTA Levittown Station
- **Source:** Boring No.: ST-3  Sample No.: S-4.5  Elev./Depth: 5.5'-8.5'
- **Remarks:**
  - Date: February 25, 2008
  - Nat. Water Content: 19.9%
  - Tested By: DFP

- **Gannett Fleming**
  - Engineers and Planners
  - Scale: USCS
**Project:** SEPTA Levittown Station  
**Client:** SEPTA  
**Boring No.:** ST-7  
**Sample No.:** S-4,5,6  
**Elev./Depth:** 4.5’-9’

<table>
<thead>
<tr>
<th>% + 3”</th>
<th>% GRAVEL</th>
<th>% SAND</th>
<th>% FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CRS.</td>
<td>FINE</td>
<td>CRS.</td>
</tr>
<tr>
<td>○</td>
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<td>0.0</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>LL</th>
<th>PL</th>
<th>D85</th>
<th>D60</th>
<th>D50</th>
<th>D30</th>
<th>D15</th>
<th>D10</th>
<th>Cc</th>
<th>Cu</th>
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<tr>
<td>N/A</td>
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<td></td>
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</table>

**MATERIAL DESCRIPTION**

- Brown silty SAND  
- USCS: SM  
- AASHTO: A-4(0)

**Remarks:**
- Date: February 25, 2008  
- Nat. Water Content: 19.0%  
- Tested By: DFP

**SEPTA 048583.A100.0006 A-4(0) SM Brown silty SAND**

**Date:** February 25, 2008  
**Nat. Water Content:** 19.0%  
**Tested By:** DFP

---

**Particle Size Distribution Report**

![Graph showing particle size distribution](image)

**Scale:** USCS
Particle Size Distribution Report

<table>
<thead>
<tr>
<th>GRAIN SIZE - mm</th>
<th>0.000</th>
<th>0.001</th>
<th>0.010</th>
<th>0.100</th>
<th>1.000</th>
<th>2.000</th>
<th>3.000</th>
<th>5.000</th>
<th>7.000</th>
<th>10.000</th>
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</thead>
<tbody>
<tr>
<td>PERCENT FINER</td>
<td>100</td>
<td>90</td>
<td>80</td>
<td>70</td>
<td>60</td>
<td>50</td>
<td>40</td>
<td>30</td>
<td>20</td>
<td>10</td>
</tr>
</tbody>
</table>

% + 3"

<table>
<thead>
<tr>
<th>CRS.</th>
<th>FINE</th>
<th>CRS.</th>
<th>MEDIUM</th>
<th>FINE</th>
<th>SILT</th>
<th>CLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.3</td>
<td>47.9</td>
<td>48.4</td>
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</tr>
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</table>

% GRAVEL

<table>
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<tr>
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<th>D85</th>
<th>D60</th>
<th>D50</th>
<th>D30</th>
<th>D15</th>
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<th>Cu</th>
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<tr>
<td>18</td>
<td>NP</td>
<td>0.238</td>
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<td>0.0876</td>
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</tbody>
</table>

% SAND

MATERIAL DESCRIPTION

<table>
<thead>
<tr>
<th>USCS</th>
<th>AASHTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM</td>
<td>A-4(0)</td>
</tr>
</tbody>
</table>

Remarks:
- Date: February 25, 2008
- Nat. Water Content: 17.9%
- Tested By: DFP

Project No.: 048583.A100.0006
Project: SEPTA Levittown Station

Source: Boring No.: ST-8  Sample No.: S-2,3  Elev./Depth: 1.5'-4.5'
Particle Size Distribution Report

% + 3"  % GRAVEL  % SAND  % FINES

<table>
<thead>
<tr>
<th></th>
<th>CRS.</th>
<th>FINE</th>
<th>CRS.</th>
<th>MEDIUM</th>
<th>FINE</th>
<th>SILT</th>
<th>CLAY</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>0.0</td>
<td>0.0</td>
<td>4.0</td>
<td>1.2</td>
<td>6.1</td>
<td>41.6</td>
<td>47.1</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>LL</th>
<th>PL</th>
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<th>D60</th>
<th>D50</th>
<th>D30</th>
<th>D15</th>
<th>D10</th>
<th>Cc</th>
<th>Cu</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>21</td>
<td>19</td>
<td>0.302</td>
<td>0.123</td>
<td>0.0854</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MATERIAL DESCRIPTION  USCS  AASHTO
Brown silty SAND  SM  A-4(0)

Project No. 048583.A100  Client: SEPTA
Project: SEPTA Levittown Station

Source: Boring No.: ST-9  Sample No.: S-4.5  Elev./Depth: 4.5'-7.5'

Remarks:
Date: February 25, 2008
Nat. Water Content: 21.3%
Tested By: DFP

Scale: USCS
### Particle Size Distribution Report

#### Project:
- Client: SEPTA
- Project: SEPTA Levittown Station

#### Remarks:
- Source: Boring No.: ST-10
- Sample No.: S-2,3
- Elev./Depth: 1.5'-4.5'
- Date: February 25, 2008
- Nat. Water Content: 19.6%
- Tested By: DFP

#### Material Description:
- Type: Brown sandy SILT

#### Test Results:
- % + 3" (% GRAVEL)
- % SAND
- % FINES

<table>
<thead>
<tr>
<th>% + 3&quot;</th>
<th>% GRAVEL</th>
<th>% SAND</th>
<th>% FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRS.</td>
<td>FINE</td>
<td>CRS.</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>3.0</td>
<td>0.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LL</th>
<th>PL</th>
<th>D_{85}</th>
<th>D_{60}</th>
<th>D_{50}</th>
<th>D_{30}</th>
<th>D_{15}</th>
<th>D_{10}</th>
<th>C_C</th>
<th>C_U</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>21</td>
<td>0.597</td>
<td>0.101</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### SCALE:
- USCS
- AASHTO: ML, A-4(0)
Particle Size Distribution Report

PERCENT FINER

GRAIN SIZE - mm

% + 3"
% GRAVEL
% SAND
% FINES

<table>
<thead>
<tr>
<th>% + 3&quot;</th>
<th>% GRAVEL</th>
<th>% SAND</th>
<th>% FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRS.</td>
<td>FINE</td>
<td>CRS.</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>3.2</td>
<td>0.7</td>
</tr>
</tbody>
</table>

X

LL  PL  D85  D60  D50  D30  D15  D10  CC  CU

N/A  NP  0.282 0.130 0.0849

MATERIAL DESCRIPTION

USCS  AASHTO

SM  A-4(0)

Project No.  048583.A100.0 Client: SEPTA
Project: SEPTA Levittown Station

Source: Boring No.: ST-13  Sample No.: S-2,3,4  Elev./Depth: 1.5'-6'

Remarks:
Date: February 25, 2008
Nat. Water Content: 13.6%
Tested By: DFP

Scale: USCS
Particle Size Distribution Report

<table>
<thead>
<tr>
<th>% + 3&quot;</th>
<th>% GRAVEL</th>
<th>% SAND</th>
<th>% FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRS.</td>
<td>FINE</td>
<td>CRS.</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>13.1</td>
<td>4.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LL</th>
<th>PL</th>
<th>D_{85}</th>
<th>D_{60}</th>
<th>D_{50}</th>
<th>D_{30}</th>
<th>D_{15}</th>
<th>D_{10}</th>
<th>C_{c}</th>
<th>C_{u}</th>
</tr>
</thead>
<tbody>
<tr>
<td>----</td>
<td>NP</td>
<td>3.65</td>
<td>0.531</td>
<td>0.426</td>
<td>0.284</td>
<td>0.147</td>
<td>0.0394</td>
<td>3.85</td>
<td>13.48</td>
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</table>

MATERIAL DESCRIPTION

- Brown poorly graded SAND with silt

**Project No.**: 048583.A1000.A100.0006
**Client**: SEPTA
**Project**: SEPTA Levittown Station

- **Date**: September 17, 2008
- **Nat. Water Content**: 1.5%
- **Source**: Boring No.: TU-1  Sample No.: S-4  Elev./Depth: 6'-8'
- **Tested By**: DFP

Scale: USCS
### Particle Size Distribution Report

#### PERCENT FINER

| GRAIN SIZE - mm | 0.001 | 0.01 | 0.1 | 0.2 | 0.5 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 | 10.0 | 20.0 | 30.0 | 40.0 | 50.0 | 60.0 | 70.0 | 80.0 | 90.0 | 100.0 |
|----------------|-------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 0.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 4.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 6.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 7.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 8.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 9.0           | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10.0          | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 20.0          | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 30.0          | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 40.0          | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 50.0          | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 60.0          | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 85.0          | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 100.0         | 0.0   | 0.0  | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

#### MATERIAL DESCRIPTION

- **Source:** Boring No.: TU-1  
- **Sample No.:** S-6,8,9  
- **Elev./Depth:** 10'-18'

---

**Remarks:**

- Date: September 17, 2008  
- Nat. Water Content: 10.0%  
- Tested By: DFP

---

**Scale:** USCS
## Particle Size Distribution Report

### Remarks

**Client:** SEPTA  
**Project:** SEPTA Levittown Station  
**Sample No.:** S-12,13,14  
**Elev./Depth:** 22'-28'  
**Source:** Boring No.: TU-1  
**Date:** September 17, 2008  
**Nat. Water Content:** 9.6%  
Tested By: DFP

### Table: Particle Size Distribution

<table>
<thead>
<tr>
<th>GRAIN SIZE - mm</th>
<th>% FINER</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 in.</td>
<td>100</td>
</tr>
<tr>
<td>3 in.</td>
<td>100</td>
</tr>
<tr>
<td>2 in.</td>
<td>100</td>
</tr>
<tr>
<td>1-1/2 in.</td>
<td>100</td>
</tr>
<tr>
<td>1 in.</td>
<td>100</td>
</tr>
<tr>
<td>3/4 in.</td>
<td>100</td>
</tr>
<tr>
<td>1/2 in.</td>
<td>100</td>
</tr>
<tr>
<td>3/8 in.</td>
<td>100</td>
</tr>
<tr>
<td>#4</td>
<td>100</td>
</tr>
<tr>
<td>#10</td>
<td>100</td>
</tr>
<tr>
<td>#20</td>
<td>100</td>
</tr>
<tr>
<td>#30</td>
<td>100</td>
</tr>
<tr>
<td>#40</td>
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<td>#100</td>
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</tr>
<tr>
<td>#140</td>
<td>100</td>
</tr>
<tr>
<td>#200</td>
<td>100</td>
</tr>
</tbody>
</table>

### Chart: Particle Size Distribution

- **% + 3"**
  - CRS: 0.0
  - FINE: 14.2
  - % Fines: 25.4
- **% GRAVEL**
  - CRS: 8.2
  - MEDIUM: 18.0
  - FINE: 24.0
- **% SAND**
  - FINE: 8.6
  - SILT: 1.6

### Brown poorly graded SAND with silt and gravel

### Scale: USCS
### Material Description

<table>
<thead>
<tr>
<th>PERCENT FINER</th>
<th>GRAIN SIZE - mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.001</td>
</tr>
<tr>
<td>90</td>
<td>0.01</td>
</tr>
<tr>
<td>80</td>
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<tr>
<td>70</td>
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</tr>
<tr>
<td>60</td>
<td>0.10</td>
</tr>
<tr>
<td>50</td>
<td>0.20</td>
</tr>
<tr>
<td>40</td>
<td>0.50</td>
</tr>
<tr>
<td>30</td>
<td>1.00</td>
</tr>
<tr>
<td>20</td>
<td>2.00</td>
</tr>
<tr>
<td>10</td>
<td>5.00</td>
</tr>
<tr>
<td>6 in.</td>
<td>20.00</td>
</tr>
<tr>
<td>3 in.</td>
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### Particle Size Distribution Report

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<th>D30</th>
<th>D15</th>
<th>D10</th>
<th>Cc</th>
<th>Cu</th>
</tr>
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<tbody>
<tr>
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- **Material Description:** Brown silty SAND with gravel
- **Scale:** USCS
- **Source:** Boring No.: TU-1  Sample No.: S-16,17  Elev./Depth: 33'-40'

**Remarks:**
- Date: September 17, 2008  Nat. Water Content: 11.5%
- Tested By: DFP

**Gannett Fleming**

ENGINEERS AND PLANNERS
### Particle Size Distribution Report

#### Test Information
- **Project No.:** 048583.A100
- **Client:** SEPTA
- **Project:** SEPTA Levittown Station
- **Date:** September 29, 2008
- **Nat. Water Content:** 16.7%
- **Source:** Boring No.: TU-2, Sample No.: S-2,3, Elev./Depth: 2'-6'
- **Remarks:**
  - **Date:** September 29, 2008
  - **Nat. Water Content:** 16.7%
  - **Tested By:** DFP

#### Material Description
- **MATERIAL DESCRIPTION:**
  - **USCS:** ML
  - **AASHTO:**

#### Particle Size Distribution
- **Grain Size - mm**
  - 0.001
  - 0.001
  - 0.01
  - 0.1
  - 1
  - 10
  - 20
  - 50
  - 100
  - 200

#### Table: Particle Size Distribution

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<th>% FINES</th>
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#### Remarks:

**Brown sandy SILT**
### AASHTO USCS MATERIAL DESCRIPTION

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### TESTED ANALYSIS

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**MATERIAL DESCRIPTION**

- Brown poorly graded SAND with silt and gravel

**PROJECT INFORMATION**

- **Project No.:** 048583.A100
- **Client:** SEPTA
- **Project:** SEPTA Levittown Station
- **Source:** Boring No.: TU-2
- **Sample No.:** S-9
- **Elev./Depth:** 16'-18'

**Remarks:**

- **Date:** September 29, 2008
- **Nat. Water Content:** 8.1%
- **Tested By:** DFP

**Scale:** USCS
### Particle Size Distribution Report

#### Project:

SEPTA Levittown Station

#### Remarks:

- **Client:** SEPTA
- **Project No.:** 048583.A100
- **Date:** September 17, 2008
- **Source:** Boring No.: TU-3, Sample No.: S-2
- **Elev./Depth:** 2'-4'
- **Nat. Water Content:** 4.4%
- **Tested By:** DFP

#### Source Information:
- **Boring No.:** TU-3
- **Sample No.:** S-2
- **Elev./Depth:** 2'-4'

#### Test Data:

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<td>MEDIUM</td>
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#### Material Description:

- Brown silty SAND with gravel

#### Test Method:

- **Scale:** USCS
- **Test Method:** AASHTO USCS

#### Test Results:

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<th>D15</th>
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<th>CU</th>
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</thead>
<tbody>
<tr>
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#### Test Parameters:

- **Source:** Boring No.: TU-3
- **Sample No.:** S-2
- **Elev./Depth:** 2'-4'
Particle Size Distribution Report

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<th>% SAND</th>
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<tr>
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MATERIAL DESCRIPTION

- Brown silty SAND with gravel

Source: Boring No.: TU-3  Sample No.: S-4.5  Elev./Depth: 6'-10'

Scale: USCS

Remarks:
- Date: September 17, 2008
- Nat. Water Content: 12.5%
- Tested By: DFP
Particle Size Distribution Report

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<td>0.002</td>
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<td>0.007</td>
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<th>% SAND</th>
<th>% FINES</th>
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MATERIAL DESCRIPTION

- Brown sandy SILT

**Project No.:** 048583.A100.0006  **Client:** SEPTA
**Project:** SEPTA Levittown Station

- **Source:** Boring No.: TU-3  **Sample No.:** S-7,8  **Elev./Depth:** 12'-16'

**Remarks:**
- Date: September 17, 2008
- Nat. Water Content: 17.6%
- Tested By: DFP

**Scale:** USCS

**Scale: USCS**
iei

Particle Size Distribution Report

<table>
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<th>60</th>
<th>50</th>
<th>40</th>
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<td>% SAND</td>
<td>% FINES</td>
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<td>D10</td>
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<td>Cu</td>
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MATERIAL DESCRIPTION

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Remarks:

- Date: September 17, 2008
- Nat. Water Content: 8.9%
- Tested By: DFP

Scale: USCS
Particle Size Distribution Report

% + 3"

% GRAVEL

% SAND

% FINES

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Material Description

- Brown silty GRAVEL with sand

Project No.: 048583.A100.0006
Client: SEPTA
Project: SEPTA Levittown Station

- Source: Boring No.: TU-3
- Sample No.: S-13,14,15
- Elev./Depth: 24'-30'

Remarks:
- Date: September 17, 2008
- Nat. Water Content: 9.5%
- Tested By: DFP

Scale: USCS
Crop Report

PERCENT FINER

- % + 3"
  - CRS.
  - FINE
  - % GRAVEL
  - % SAND
  - % FINES
  - CRS.
  - MEDIUM
  - FINE
  - SILT
  - CLAY
  - 0.0
  - 0.0
  - 6.7
  - 2.4
  - 30.1
  - 43.9
  - 11.3
  - 5.6

LL
PL
D85
D60
D50
D30
D15
D10
Cc
Cu

- ----
- NP
- 0.832
- 0.419
- 0.354
- 0.243
- 0.0490
- 0.0186
- 7.59
- 22.57

MATERIAL DESCRIPTION

- Brown silty SAND

Scale: USCS

Project No. 048583.A100 Client: SEPTA
Project: SEPTA Levittown Station

- Source: Boring No.: TU-3 Sample No.: S-16 Elev./Depth: 33'-35'

Remarks:
- Date: September 17, 2008
  Nat. Water Content: 20.3%

Tested By: DFP

Gannett Fleming
ENGINEERS AND PLANNERS

Scale: USCS
Particle Size Distribution Report

<table>
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<th>D₅₀</th>
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<th>D₁₅</th>
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MATERIAL DESCRIPTION

- Gray well-graded SAND with silt

SEPTA 048583.A100.0006

Sw-Sm: Gray well-graded SAND with silt

Nat. Water Content: 15.9%

Tested By: DFP

Scale: USCS
### Particle Size Distribution Report

#### Table: Grain Size Distribution

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<th>% FINES</th>
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<td>MEDIUM</td>
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#### Material Description

- **MATERIAL DESCRIPTION**: Brown silty SAND
- **USCS**: SM
- **AASHTO**: 

Project No.: 048583.A1001

**Client**: SEPTA

**Project**: SEPTA Levittown Station

- **Source**: Boring No.: TU-3  
  **Sample No.**: S-21  
  **Elev./Depth**: 58'-60'

**Remarks**:
- Date: September 17, 2008
- Nat. Water Content: 21.9%
- Tested By: DFP

Scale: USCS
## Particle Size Distribution Report

### PERCENT FINER

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<th>40</th>
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<th>20</th>
<th>10</th>
<th>0</th>
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</thead>
<tbody>
<tr>
<td>GRAIN SIZE - mm</td>
<td>100</td>
<td>200</td>
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### GRANULARITY

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### OBSERVATIONS

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<th>D&lt;sub&gt;85&lt;/sub&gt;</th>
<th>D&lt;sub&gt;60&lt;/sub&gt;</th>
<th>D&lt;sub&gt;50&lt;/sub&gt;</th>
<th>D&lt;sub&gt;30&lt;/sub&gt;</th>
<th>D&lt;sub&gt;15&lt;/sub&gt;</th>
<th>D&lt;sub&gt;10&lt;/sub&gt;</th>
<th>C&lt;sub&gt;C&lt;/sub&gt;</th>
<th>C&lt;sub&gt;U&lt;/sub&gt;</th>
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<td>0.0022</td>
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### MATERIAL DESCRIPTION

- **USCS**: SM
- **AASHTO**: SM

### Project Details

- **Project No.**: 048583.A100
- **Client**: SEPTA
- **Project**: SEPTA Levittown Station
- **Source**: Boring No.: TU-3
- **Sample No.**: S-22,23
- **Elev./Depth**: 63'-70'

### Remarks

- **Date**: September 17, 2008
- **Nat. Water Content**: 19.0%
- **Tested By**: DFP

### Scale

- **USCS**
### Engineers Field Boring Log

**Project Name:** SEPTA Levittown Station  
**County:** Bucks

**Station:**  
**Offset from Centerline:**

**North:** 307,241.18'  
**East:** 2,787,975.76'

**State RT. No.:**  
**Sect.:**  
**Segment:**  
**Offset:**

**Inspector:** H. Fenton  
**Drillers Name/Company:** J. Kurzuynawski/JBD

**Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer

**Drilling Methods:** HSA, Continuous SS Sampling

**Casing:**  
**Depth:**

**Water:**  
**Depth:**  
**Time:**

**Checked by:** A. Sheth  
**Date:** 3/7/08

---

<table>
<thead>
<tr>
<th>Depth (FT)</th>
<th>Sample No/Type/Core Run</th>
<th>Reversals</th>
<th>Recovery (%)</th>
<th>Pocket Pent/ Torvaine (TFS)</th>
<th>UCS</th>
<th>Aashto</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
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<td>m</td>
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<td>Silty SAND (sm), brown to gray, moist to wet, medium dense</td>
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<td>3.0</td>
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<td>S3</td>
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<td>10</td>
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<td>sm</td>
<td>m-w</td>
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<td></td>
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<tr>
<td>5.0</td>
<td>S6</td>
<td>11</td>
<td>100</td>
<td>sm</td>
<td>w</td>
<td></td>
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</table>

Bottom of borehole at 10.0 feet.

---

**Note:** Draw stratification lines at the approximate boundary between soil types for this boring location and show depths.
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/ CORE RUN</th>
<th>BLOWS/ 0.5 FT. ON SAMPLER</th>
<th>RECOVERY</th>
<th>POCKET PENT/ TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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<tr>
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</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1</td>
<td>9</td>
<td>9</td>
<td>0.5'</td>
<td>sm</td>
<td>m</td>
<td></td>
<td></td>
<td>Silty SAND (SM), brown, moist, medium dense to very dense</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>4</td>
<td>9</td>
<td>1.3'</td>
<td>SM</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>12</td>
<td>27</td>
<td>1.0'</td>
<td>SM</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>S4</td>
<td>50/0.3</td>
<td>0.3'</td>
<td>100</td>
<td>gm</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>100/0</td>
<td>0.0'</td>
<td>0</td>
<td></td>
<td>m</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>8.0</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Bottom of borehole at 8.0 feet.</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/ CORE RUN</th>
<th>RECOVERY</th>
<th>POCKET PENT/ TORSION (TSF)</th>
<th>UCCS</th>
<th>AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
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<tbody>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.3 ASPHALT</td>
<td>16.1</td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td>29</td>
<td>60</td>
<td>sp</td>
<td>m</td>
<td></td>
<td>SUBBASE</td>
<td>15.4</td>
</tr>
<tr>
<td>2.5</td>
<td>S1 29/33</td>
<td>0.9'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SAND with silt and gravel (sp), brown, moist, medium dense to very dense</td>
<td>Boring drilled in pavement area, borehole was backfilled on the same day.</td>
</tr>
<tr>
<td>2.8</td>
<td>S2 50/0.3</td>
<td>0.0'</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>S3 6</td>
<td>0.6'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>S4 15/10</td>
<td>0.9'</td>
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<td></td>
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</tr>
<tr>
<td>8.5</td>
<td>S5 8</td>
<td>0.8'</td>
<td>53</td>
<td>sp</td>
<td>m-w</td>
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<tr>
<td>10.0</td>
<td>S6 12/10</td>
<td>1.2'</td>
<td>80</td>
<td>sp</td>
<td>w</td>
<td></td>
<td>Bottom of borehole at 10.0 feet.</td>
<td></td>
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<tr>
<td>DEPTH (FT)</td>
<td>SAMPLE NO./TYPE/CORE RUN</td>
<td>BLOWS/0.5 FT ON SAMPLER</td>
<td>RECOVERY (F.L.)</td>
<td>POCKET PENT/TORVANE (TSF)</td>
<td>RECOVERY (%)</td>
<td>RODG (%)</td>
<td>USCS</td>
<td>AASHTO</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------</td>
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<td>----------------</td>
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<td>S1</td>
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<td>4.0</td>
<td>S3</td>
<td>6</td>
<td>7</td>
<td>60</td>
<td>mi</td>
<td>m</td>
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<td></td>
</tr>
<tr>
<td>5.5</td>
<td>S4</td>
<td>9</td>
<td>9</td>
<td>8</td>
<td>sm</td>
<td>m-w</td>
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<td>8</td>
<td>40</td>
<td>sm</td>
<td>m-w</td>
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<td>S6</td>
<td>15</td>
<td>10</td>
<td>60</td>
<td>sm</td>
<td>m-w</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Checked = No Recorded Water Reading Measurements

PID readings for all samples is zero.

Boring was drilled in the pavement area and was backfilled on the same day.

Bottom of borehole at 10.0 feet.
Boring was drilled in the pavement area and was backfilled on the same day.

<table>
<thead>
<tr>
<th>SAMPLE NO.</th>
<th>TYPE/CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/TORVANE (TF%)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
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<tbody>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>0.3 ASPHALT</td>
<td>17.5</td>
</tr>
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<td>1.0</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>1.0 SUBBASE</td>
<td>16.8</td>
</tr>
<tr>
<td>0.0</td>
<td>S1</td>
<td>26</td>
<td>0.7'</td>
<td>sm</td>
<td>m</td>
<td></td>
<td></td>
<td>Silty SAND with gravel (sm), brown, moist, dense to very dense</td>
<td>Boring was drilled in the pavement area and was backfilled on the same day.</td>
</tr>
<tr>
<td>2.5</td>
<td>S1</td>
<td>32</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>S2</td>
<td>16</td>
<td>0.3'</td>
<td>sm</td>
<td>m</td>
<td></td>
<td></td>
<td>Sandy SILT (ml), gray, moist, medium dense</td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td>S3</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>S4</td>
<td>5</td>
<td>0.5'</td>
<td>mi</td>
<td>m</td>
<td></td>
<td></td>
<td>SAND with sil (sp), brown, moist to wet, medium dense</td>
<td></td>
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<tr>
<td>8.5</td>
<td>S5</td>
<td>9</td>
<td>0.8'</td>
<td>sp</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>S6</td>
<td>7</td>
<td>0.9'</td>
<td>sp</td>
<td>w</td>
<td></td>
<td></td>
<td>Bottom of borehole at 10.0 feet.</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
### ENGINEERS FIELD BORING LOG

**BORING NO:** P-6  
**DATE:** START 1/31/08  
**O.G. END 1/31/08**  
**ELEV. 16.5**

**PROJECT NAME:** SEPTA Levittown Station  
**COUNTY:** Bucks  
**OFFSET FROM CENTERLINE:**

**NORTHING:** 307,848.25'  
**EASTING:** 2,788,440.87'  
**STATE RT. NO.:**  
**SECT.:**  
**SEGMENT:**  
**OFFSET:**

**INSPECTOR:** H. Fenton  
**DRILLERS NAME/COMPANY:** J. Kurzuynawski/JBD

**EQUIPMENT USED:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer  
**DRILLING METHODS:** HSA, Continuous SS Sampling

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/CORE RUN</th>
<th>BLOWS/0.5 FT ON SAMPLER</th>
<th>RECOVERY</th>
<th>POCKET PENET/TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>O.C.</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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<td>ASPHALT</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>SUBBASE</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>S1</td>
<td>12, 12</td>
<td>1.0'</td>
<td>gm</td>
<td>m</td>
<td>m</td>
<td></td>
<td>Sandy GRAVEL with silt (gm), brown, moist, medium dense</td>
<td>14.0</td>
</tr>
<tr>
<td>3.0</td>
<td>S2</td>
<td>3, 3</td>
<td>0.8'</td>
<td>ml</td>
<td>m</td>
<td>m</td>
<td></td>
<td>Sandy SILT (ML), brown, moist, loose to dense</td>
<td>14.0</td>
</tr>
<tr>
<td>5.5</td>
<td>S3</td>
<td>4, 5</td>
<td>0.9'</td>
<td>ML</td>
<td>m</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>S4</td>
<td>6, 11</td>
<td>0.3'</td>
<td>ML</td>
<td>m</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5</td>
<td>S5</td>
<td>14, 31</td>
<td>0.7'</td>
<td>ml</td>
<td>m-w</td>
<td>m-w</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>S6</td>
<td>35, 51</td>
<td>1.2'</td>
<td>gm</td>
<td>w</td>
<td>w</td>
<td></td>
<td>Silty Sandy GRAVEL (gm), brown, wet, very dense</td>
<td></td>
</tr>
</tbody>
</table>

**ERECTION LOCATION:**

- **EASTING:** 2,788,440.87'  
- **NORTHING:** 307,848.25'

**OFFSET FROM CENTERLINE:**

- **STATE RT. NO.:**
- **SECT.:**
- **SEGMENT:**
- **OFFSET:**

**REMARKS:**

- **CHECKED BY:** A. Sheth  
- **DATE:** 3/7/08  
- **DEPTH:** 8.5'  
- **TIME:** --  
- **DATE:** 1/31/08

**NOTE:** DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS

- **CHECKED =** No Recorded Water Reading Measurements

- **PID reading for all samples is zero.**
- **Boring was drilled in the pavement area and was backfilled on the same day.**

- **Bottom of borehole at 10.0 feet.**
# Engineers Field Boring Log

**Project Name:** SEPTA Levittown Station  
**County:** Bucks  
**Station:**  
**Offset from Centerline:**  
**NORTHING:** 308,026.28'  
**EASTING:** 2,788,448.47'  
**State Rt. No.:**  
**Section:**  
**Segment:**  
**Offset:**  
**Inspector:** H. Fenton  
**Engineers Field Boring Log:**  
**Form No.:** D-481 (12/89)  
**Reproduce Locally**  

**Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer  
**Drilling Methods:** HSA, Continuous SS Sampling

<table>
<thead>
<tr>
<th>Sample No./Type/Core Run</th>
<th>Recovery (Ft)</th>
<th>Recovery (%)</th>
<th>Rod (%)</th>
<th>Pocket Pent/Torvane (TSF)</th>
<th>Uscs</th>
<th>Aashto</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Asphalt Subbase</td>
<td>17.6</td>
</tr>
<tr>
<td>1.3</td>
<td>S1</td>
<td>0.0'</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Silty Sand (SM), brown, moist, medium</td>
<td>15.2</td>
</tr>
<tr>
<td>2.5</td>
<td>S2</td>
<td>1.0'</td>
<td>67</td>
<td>ml</td>
<td>m</td>
<td></td>
<td></td>
<td>Sandy Silty (ML), brown, moist, medium dense</td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>S3</td>
<td>0.6'</td>
<td>40</td>
<td>SM</td>
<td>m</td>
<td></td>
<td></td>
<td>Silty Sand (SM), brown, moist to wet, loose to dense</td>
<td>13.2</td>
</tr>
<tr>
<td>5.5</td>
<td>S4</td>
<td>1.0'</td>
<td>67</td>
<td>sm</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>S5</td>
<td>1.0'</td>
<td>67</td>
<td>sm</td>
<td>m-w</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5</td>
<td>S6</td>
<td>0.7'</td>
<td>47</td>
<td>sm</td>
<td>m-w</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>10.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bottom of borehole at 10.0 feet.</td>
<td>7.2</td>
</tr>
</tbody>
</table>

**Checked = No Recorded Water Reading Measurements**

**Note:** Draw stratification lines at the approximate boundary between soil types for this boring location and show depths.
## ENGINEERS FIELD BORING LOG

**BORING NO.** P-8  
**DATE:** START 2/7/08  
**END 2/7/08**  
**ELEV.** 17.6  
**PROJECT NAME** SEPTA Levittown Station  
**COUNTY** Bucks  
**STATE RT. NO.**  
**SECT.**  
**SEGMENT**  
**OFFSET**  
**FORM NO:** D-481  
**(12/89)**  
**REPRODUCE LOCALLY**

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/TORVANE (TSF)</th>
<th>USCS/ AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>22</td>
<td>0.4'</td>
<td>ml</td>
<td>m</td>
<td></td>
<td>Sandy Silt (ML), brown, moist, medium dense</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1.0</td>
<td>1.0'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>10</td>
<td>1.0'</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>24</td>
<td>0.9'</td>
<td>sp</td>
<td>w</td>
<td></td>
<td>Bottom of borehole at 10.0 feet.</td>
<td></td>
</tr>
</tbody>
</table>

**CASING:** Size:  
**DEPTH:**  
**WATER:** DEPTH: 9.0' TIME: -- DATE: 2/7/08  
**CHECKED BY:** A. Sheth  
**DATE:** 3/7/08  
**DEPT:**  
**TIME:**  
**DATE:**

**EQUIPMENT USED:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer  
**DRILLING METHODS:** HSA, Continuous SS Sampling  
**INSPECTOR:** H. Fenton  
**DRILLERS NAME/COMPANY:** J. Kurzuynawski/JBD

**CHECKED = No Recorded Water Reading Measurements**

**NOTES:**
- **DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS**
- **NOTE:** H2O CONTENT

**REMARKS:**
- PID reading for all samples is zero.
- Boring was drilled in the pavement area and was backfilled on the same day.
# Engineers Field Boring Log

**BORING NO:** ST-1  
**DATE:** START: 1/30/08  
**O.G. END:** 1/30/08  
**ELEV:** 17.2

**PROJECT NAME:** SEPTA Levittown Station  
**COUNTY:** Bucks

**STATION**  
**OFFSET FROM CENTERLINE**

**NORTHING:** 307,482.19'  
**EASTING:** 2,788,221.53'

**STATE RT. NO.**  
**SECT.**  
**SEGMENT**  
**OFFSET**

**INSPECTOR:**  
**DRILLERS NAME/COMPANY:** J. Kurzuynawski/JBD

**EQUIPMENT USED:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer

**DRILLING METHODS:** HSA, Continuous SS Sampling

---

**DEPT. (FT)** | **SAMPLE NO./TYPE/RECOVERY** | **POCKET PENT/TORVANE** | **USCS** | **AASHTO** | **H2O CONTENT** | **DESCRIPTION** | **REMARKS**
---|---|---|---|---|---|---|---
0.0 | -- | - | - | - | - | 0.3 ASPHALT | 16.9
1.0 | -- | - | - | - | - | 1.0 SUBBASE | 16.2

<table>
<thead>
<tr>
<th>DEPT. (FT)</th>
<th>SAMPLE NO./TYPE/RECOVERY</th>
<th>POCKET PENT/TORVANE</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
</table>
0.0 | -- | - | - | - | - | 0.3 ASPHALT | 16.9
1.0 | -- | - | - | - | - | 1.0 SUBBASE | 16.2

<table>
<thead>
<tr>
<th>DEPT. (FT)</th>
<th>SAMPLE NO./TYPE/RECOVERY</th>
<th>POCKET PENT/TORVANE</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
</table>
0.0 | -- | - | - | - | - | 0.3 ASPHALT | 16.9
1.0 | -- | - | - | - | - | 1.0 SUBBASE | 16.2

---

**NOTE:** DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./TYPE/Core Run</th>
<th>BLOWS/0.5FT. ON SAMPLER</th>
<th>RECOVERY(FL)</th>
<th>POCKET PENT/TORVANE(TSF)</th>
<th>USCS</th>
<th>AASHO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.1</td>
<td>20/0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.5</td>
<td>S14</td>
<td>46</td>
<td>60</td>
<td>80</td>
<td>gw-gm</td>
<td></td>
<td></td>
<td>Well-Graded GRAVEL with silt and sand (GW-GM), brown, wet, very dense (continued)</td>
<td></td>
</tr>
<tr>
<td>22.0</td>
<td>S15</td>
<td>20</td>
<td>41</td>
<td>0.8'</td>
<td>gw-gm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.5</td>
<td>S16</td>
<td>51</td>
<td>50/0.3</td>
<td>0.8'</td>
<td>gw-gm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.3</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.0</td>
<td>S17</td>
<td>18</td>
<td>34</td>
<td>1.0'</td>
<td>gw-gm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.5</td>
<td>S18</td>
<td>19</td>
<td>30</td>
<td>1.2'</td>
<td>sp</td>
<td></td>
<td></td>
<td>SAND with gravel (sp), brown, wet, very dense</td>
<td>-9.3</td>
</tr>
<tr>
<td>28.0</td>
<td>S19</td>
<td>30</td>
<td>13</td>
<td>0.7'</td>
<td>sp</td>
<td></td>
<td></td>
<td></td>
<td>-12.3</td>
</tr>
<tr>
<td>29.5</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Bottom of borehole at 29.5 feet.</td>
<td></td>
</tr>
</tbody>
</table>
**ENGINEERS FIELD BORING LOG**

**BORING NO.** ST-2

**Date:** START 2/4/08  END 2/4/08

**STATE RT. NO.:**  **COUNTY:** Bucks

**DEPT.:** 28.5'  **WATER:** 8.2'

**CHECKED BY:** A. Sheth  **DATE:** 3/7/08  **DATE:** 2/5/08

**EQUIPMENT USED:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer

**DRILLING METHODS:** HSA, Continuous SS Sampling

---

### Table

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/ CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%) POCKET PENT/ TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>S1</td>
<td>6</td>
<td>0.4' 27</td>
<td>-</td>
<td>-</td>
<td>m</td>
<td>SILT with gravel (ml), dark brown, moist, medium dense to dense</td>
</tr>
<tr>
<td>1.5</td>
<td>S2</td>
<td>22</td>
<td>0.1' 7</td>
<td>-</td>
<td>-</td>
<td>m</td>
<td>Sandy SILT (ML), brown, moist, medium dense to very dense</td>
</tr>
<tr>
<td>3.0</td>
<td>S3</td>
<td>10</td>
<td>1.1' 73</td>
<td>-</td>
<td>-</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>S4</td>
<td>7</td>
<td>1.1' 73</td>
<td>PP 2.0</td>
<td>ML</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>S5</td>
<td>23</td>
<td>0.7' 47</td>
<td>PP 3.0</td>
<td>-</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>S6</td>
<td>31</td>
<td>1.2' 80</td>
<td>-</td>
<td>-</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>9.0</td>
<td>S7</td>
<td>18</td>
<td>0.5' 33</td>
<td>-</td>
<td>-</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>10.5</td>
<td>S8</td>
<td>40</td>
<td>1.0' 71</td>
<td>-</td>
<td>-</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>11.9</td>
<td>S9</td>
<td>75/0.5</td>
<td>0.4' 80</td>
<td>-</td>
<td>-</td>
<td>w</td>
<td>Silty Sandy GRAVEL (gp-gm), brown, wet, very dense</td>
</tr>
<tr>
<td>12.0</td>
<td>S10</td>
<td>43</td>
<td>0.5' 36</td>
<td>-</td>
<td>-</td>
<td>w</td>
<td></td>
</tr>
<tr>
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<td>S11</td>
<td>54/0.3</td>
<td>0.2' 67</td>
<td>-</td>
<td>-</td>
<td>w</td>
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</tr>
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<td>S12</td>
<td>51</td>
<td>1.0' 67</td>
<td>-</td>
<td>-</td>
<td>w</td>
<td></td>
</tr>
<tr>
<td>14.9</td>
<td>S13</td>
<td>25</td>
<td>0.5' 33</td>
<td>-</td>
<td>-</td>
<td>w</td>
<td>SAND and gravel (sp), brown, wet, very dense</td>
</tr>
<tr>
<td>15.3</td>
<td></td>
<td>24</td>
<td>0.5' 33</td>
<td>-</td>
<td>-</td>
<td>w</td>
<td></td>
</tr>
<tr>
<td>16.5</td>
<td></td>
<td>28</td>
<td>0.5' 33</td>
<td>-</td>
<td>-</td>
<td>w</td>
<td></td>
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</tbody>
</table>

**NOTES:** DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.0</td>
<td>S14</td>
<td>22</td>
<td>0.8'</td>
<td>-</td>
<td>sp</td>
<td>w</td>
<td></td>
<td>SAND and gravel (sp), brown, wet, very dense (continued)</td>
<td></td>
</tr>
<tr>
<td>22.0</td>
<td>S15</td>
<td>36</td>
<td>0.6'</td>
<td>-</td>
<td>sp</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.0</td>
<td>S16</td>
<td>50/0.3</td>
<td>0.8'</td>
<td>100</td>
<td>sp</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td>-8.9</td>
</tr>
<tr>
<td>24.5</td>
<td>S17</td>
<td>50/0.5</td>
<td>0.5'</td>
<td>100</td>
<td>sp</td>
<td>w</td>
<td></td>
<td>Poorly-Graded SAND with gravel (sp), brown, wet, very dense</td>
<td></td>
</tr>
<tr>
<td>25.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.0</td>
<td>S18</td>
<td>50/0.5</td>
<td>0.5'</td>
<td>100</td>
<td>sp</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.5</td>
<td>S19</td>
<td>39</td>
<td>0.6'</td>
<td>40</td>
<td>sp</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.5</td>
<td>S20</td>
<td>50/0.5</td>
<td>0.6'</td>
<td>60</td>
<td>sp</td>
<td>w</td>
<td></td>
<td>Bottom of borehole at 29.5 feet.</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
### Engineers Field Boring Log

**Project Name:** SEPTA Levittown Station  
**Location:**  
**County:** Bucks  
**Station Coordinates:** 307,583.52' North, 2,788,312.36' East  
**O.G.:** 17.4

**Inspection Details:**  
- **Check Date:** 1/29/08  
- **Checked by:** A. Sheth

**Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer

**Drilling Methods:** HSA, Continuous SS Sampling

**Date:** 1/29/08

---

**Sample Log:**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Type/Core Run</th>
<th>B hairsticks</th>
<th>Recovery (f.t.)</th>
<th>Recovery (%)</th>
<th>Pocket Pent/ Torvane (tsf)</th>
<th>USCS</th>
<th>Aashto</th>
<th>H.O. Content</th>
<th>Description</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>0.0</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.3 ASPHALT</td>
<td>17.1</td>
</tr>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>1.0 SUBBASE</td>
<td>16.4</td>
</tr>
</tbody>
</table>

- Silty SAND with gravel (sm), brown, moist, loose to dense

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Type/Core Run</th>
<th>B hairsticks</th>
<th>Recovery (f.t.)</th>
<th>Recovery (%)</th>
<th>Pocket Pent/ Torvane (tsf)</th>
<th>USCS</th>
<th>Aashto</th>
<th>H.O. Content</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
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<td>8</td>
<td>0.7'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Silty SAND (sm), brown, moist to wet, medium dense to very dense</td>
<td>11.9</td>
</tr>
<tr>
<td>4.0</td>
<td>S2</td>
<td>19</td>
<td>17</td>
<td>0.6'</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.5</td>
<td>S3</td>
<td>4</td>
<td>3</td>
<td>0.2'</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>S4</td>
<td>4</td>
<td>8</td>
<td>1.2'</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5</td>
<td>S5</td>
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<td>10.0</td>
<td>S6</td>
<td>15</td>
<td>16</td>
<td>1.5'</td>
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<tr>
<td>11.5</td>
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<td>17</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.0</td>
<td>S8</td>
<td>14</td>
<td>20</td>
<td>1.4'</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>14.5</td>
<td>S9</td>
<td>20</td>
<td>40</td>
<td>1.3'</td>
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</tr>
<tr>
<td>16.0</td>
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<td>23</td>
<td>43</td>
<td>1.2'</td>
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<td></td>
</tr>
<tr>
<td>17.5</td>
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<td>31</td>
<td>1.2'</td>
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<td>SAND with gravel and silt (sw), brown, wet, very dense</td>
<td>0.9</td>
</tr>
<tr>
<td>19.0</td>
<td>S12</td>
<td>42</td>
<td>40</td>
<td>1.3'</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>20.0</td>
<td>S13</td>
<td>25</td>
<td>60/0.5</td>
<td>0.8'</td>
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</tr>
</tbody>
</table>

**Water:**  
- **Water Reading:** PID reading for all samples is zero.

**Drillers Name/Company:** J. Kurzywnawski/JBD

---

**Other Details:**  
- **State RT. No.:**  
- **Offset from centerline:**  
- **Segment:**

---

**Note:** Draw stratification lines at the approximate boundary between soil types for this boring location and show depths.
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No./ Type/Core Run</th>
<th>B/W 0.5 ft. on Sampler</th>
<th>Recovery (%)</th>
<th>RQD (%)</th>
<th>Pocket Pent./ Torvane (TSF)</th>
<th>USCS</th>
<th>AASHO</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
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<tr>
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<td>--</td>
<td>--</td>
<td>SAND with gravel and silt (sw), brown, wet, very dense (continued)</td>
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<tr>
<td>21.5</td>
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<td>S15</td>
<td>43</td>
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<td>67/0.3</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>28.0</td>
<td>S18</td>
<td>38</td>
<td>1.0</td>
<td>67</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>w</td>
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<td>29.3</td>
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Bottom of borehole at 29.3 feet.
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO.</th>
<th>TYPE/CORE RUN</th>
<th>BLOWS/0.5 FT ON SAMPLER</th>
<th>RECOVERY(%)</th>
<th>POCKET PENT/TERVANE (TSF)</th>
<th>USCS</th>
<th>AARSTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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<tbody>
<tr>
<td>0.0</td>
<td>S1</td>
<td>5</td>
<td>11</td>
<td>67</td>
<td>ml</td>
<td>m</td>
<td></td>
<td></td>
<td>SILT with sand and gravel (ml), brown, moist, medium dense</td>
<td>PID reading for all samples is zero.</td>
</tr>
<tr>
<td>1.5</td>
<td>S1</td>
<td>15</td>
<td>18</td>
<td>80</td>
<td>sm</td>
<td>m</td>
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<td>Silty SAND with gravel (sm), brown, moist, dense</td>
<td>1.5</td>
</tr>
<tr>
<td>3.0</td>
<td>S2</td>
<td>12</td>
<td>9</td>
<td>73</td>
<td>sm</td>
<td>m</td>
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<td>Sandy SILT (ml), grayish brown to brown, moist, dense to very dense</td>
<td>3.5</td>
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<td>4.5</td>
<td>S3</td>
<td>22</td>
<td>21</td>
<td>67</td>
<td>ml</td>
<td>m</td>
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<tr>
<td>6.0</td>
<td>S4</td>
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<td>16</td>
<td>80</td>
<td>ml</td>
<td>m</td>
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<td>S5</td>
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<td>sm</td>
<td>m</td>
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<td>S7</td>
<td>53</td>
<td>70</td>
<td>38</td>
<td>sm</td>
<td>m-w</td>
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<td>Silty Sandy GRAVEL (gm), brown, moist to wet, very dense</td>
<td>10.5</td>
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<tr>
<td>11.8</td>
<td>S8</td>
<td>21</td>
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<td>60</td>
<td>gm</td>
<td>m-w</td>
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<td>36</td>
<td>0.9</td>
<td>gm</td>
<td>m-w</td>
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<tr>
<td>14.5</td>
<td>S10</td>
<td>21</td>
<td>62/0.5</td>
<td>50</td>
<td>gm</td>
<td>m-w</td>
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<td>48</td>
<td>62/0.5</td>
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<td>gm</td>
<td>m-w</td>
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<td>gm</td>
<td>m-w</td>
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<td>gm</td>
<td>m-w</td>
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<td>gmp</td>
<td>m-w</td>
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NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/ CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (FL)</th>
<th>RQD (%)</th>
<th>POCKET PENT/TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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<tbody>
<tr>
<td>20.3</td>
<td>S14 50/0.3</td>
<td>35</td>
<td>0.3</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>Silty Sandy GRAVEL (gm), brown, moist to wet, very dense (continued)</td>
<td></td>
</tr>
<tr>
<td>21.0</td>
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<td>42</td>
<td>0.4</td>
<td>27</td>
<td>gm</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td>22.5</td>
<td>S15 50</td>
<td>7</td>
<td>0.5</td>
<td>36</td>
<td>gm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>23.9</td>
<td>S16 50/0.4</td>
<td>32</td>
<td>0.5</td>
<td>33</td>
<td>gm</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>24.0</td>
<td>S17 70</td>
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<td>25.5</td>
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<td>-10.1</td>
<td>SAND with silt and gravel (sp), brown, wet, dense to very dense</td>
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</tr>
<tr>
<td>25.5</td>
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<td>0.6</td>
<td>75</td>
<td>sp</td>
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</tr>
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<td>26.3</td>
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<td>17</td>
<td>0.6</td>
<td>40</td>
<td>sp</td>
<td>-</td>
<td>-</td>
<td>-10.1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>27.0</td>
<td>S19 24</td>
<td>21</td>
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<td>27</td>
<td>sp</td>
<td>-</td>
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<td>-10.1</td>
<td>-</td>
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</tr>
<tr>
<td>28.5</td>
<td>S20 24</td>
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<td>27</td>
<td>sp</td>
<td>-</td>
<td>-</td>
<td>-10.1</td>
<td>-</td>
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<td>39</td>
<td>39</td>
<td>30.0</td>
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<td>-</td>
<td>-14.6</td>
<td>Bottom of borehole at 30.0 feet.</td>
<td>-</td>
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</table>
### Engineers Field Boring Log

**Project Name:** SEPTA Levittown Station  
**County:** Bucks

**Station Location:**  
**North:** 307,668.09'  
**Easting:** 2,788,380.86'

**Inspector:** H. Fenton  
**Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer

**Drilling Methods:** HSA, Continuous SS Sampling

**Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer

**Drillers Name/Company:** J. Kurzuynawski/JBD

**Date:** 1/29/08

---

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Type/Core Run</th>
<th>BPA (blows/0.5 ft.)</th>
<th>Recovery (%)</th>
<th>Pocket Penetration (TSP)</th>
<th>UCS (ksi)</th>
<th>AASHTO</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
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<td>0.0</td>
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<td></td>
<td></td>
<td>ASPHALT</td>
<td>17.0</td>
</tr>
<tr>
<td>1.0</td>
<td>S1</td>
<td>12</td>
<td>23</td>
<td>16</td>
<td>0.7'</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Silty SAND with gravel (sm), brown, moist, loose to dense</td>
<td>1.0 SUBBASE 16.3</td>
</tr>
<tr>
<td>2.5</td>
<td>S2</td>
<td>9</td>
<td>8</td>
<td>6</td>
<td>0.1'</td>
<td>-</td>
<td>-</td>
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<td>Silty SAND (sm), brown, moist to wet, medium dense to dense</td>
<td>5.5 11.8</td>
</tr>
<tr>
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<td>3</td>
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<td>4</td>
<td>0.5'</td>
<td>-</td>
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<td>-</td>
<td>Gravelly SAND with silt (sw), brown, wet, very dense</td>
<td>10.0 7.3</td>
</tr>
<tr>
<td>7.0</td>
<td>S4</td>
<td>4</td>
<td>4</td>
<td>8</td>
<td>0.7'</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fine SAND with silt (sp), brown, wet, medium dense to very dense</td>
<td>16.0 1.3</td>
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<tr>
<td>8.5</td>
<td>S5</td>
<td>9</td>
<td>9</td>
<td>12</td>
<td>1.2'</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Gravelly SAND with silt (sw), brown, wet, very dense</td>
<td>50.0 5.0</td>
</tr>
<tr>
<td>10.0</td>
<td>S6</td>
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<td>13</td>
<td>1.2'</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Gravelly SAND with silt (sw), brown, wet, very dense</td>
<td>50.0 5.0</td>
</tr>
<tr>
<td>11.5</td>
<td>S7</td>
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<td>17</td>
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<td>-</td>
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<td>Gravelly SAND with silt (sw), brown, wet, very dense</td>
<td>50.0 5.0</td>
</tr>
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<td>17</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>Gravelly SAND with silt (sw), brown, wet, very dense</td>
<td>50.0 5.0</td>
</tr>
<tr>
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<td>12</td>
<td>0.5'</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Gravelly SAND with silt (sw), brown, wet, very dense</td>
<td>50.0 5.0</td>
</tr>
<tr>
<td>16.0</td>
<td>S10</td>
<td>20</td>
<td>22</td>
<td>22</td>
<td>1.5'</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Gravelly SAND with silt (sw), brown, wet, very dense</td>
<td>50.0 5.0</td>
</tr>
<tr>
<td>17.5</td>
<td>S11</td>
<td>38</td>
<td>35</td>
<td>35</td>
<td>0.9'</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Gravelly SAND with silt (sw), brown, wet, very dense</td>
<td>50.0 5.0</td>
</tr>
<tr>
<td>18.0</td>
<td>S12</td>
<td>56/0.5</td>
<td>100</td>
<td>-</td>
<td>0.5'</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Gravelly SAND with silt (sw), brown, wet, very dense</td>
<td>50.0 5.0</td>
</tr>
<tr>
<td>19.0</td>
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<td></td>
<td>Draw stratification lines at the approximate boundary between soil types for this boring location and show depths</td>
<td></td>
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</table>

**Note:**
- **O.G.:** 17.3
- **Projected Water Reading Measurements (PWR):** No recorded water reading measurements
- **Drill Rig:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer
- **Drillers Name/Company:** J. Kurzuynawski/JBD
- **Drilling Methods:** HSA, Continuous SS Sampling
- **Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer
- **Drillers Name/Company:** J. Kurzuynawski/JBD
- **Date:** 1/29/08

---

**Check by:** A. Sheth  
**Date:** 3/7/08

---

**Description of Soil:**
- **Silty SAND with gravel (sm), brown, moist, loose to dense:**
- **Silty SAND (sm), brown, moist to wet, medium dense to dense:**
- **Fine SAND with silt (sp), brown, wet, medium dense to very dense:**
- **Gravelly SAND with silt (sw), brown, wet, very dense:**

---

**Remarks:**
- **PID reading for all samples is zero.**
<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No.</th>
<th>Type/Core Run</th>
<th>B/C 5 ft. on Sampler</th>
<th>Recovery (%)</th>
<th>RQD (%)</th>
<th>Pocket Penetration (T/SF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
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<tr>
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<td>Gravelly SAND with silt (sw), brown, wet, very dense (continued)</td>
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</tr>
<tr>
<td>21.5</td>
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<td>23.5</td>
<td>S16</td>
<td>77/0.5</td>
<td>43</td>
<td>1.2</td>
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</tr>
<tr>
<td>25.5</td>
<td>S17</td>
<td>80/0.5</td>
<td>43</td>
<td>0.5</td>
<td>100</td>
<td>-</td>
<td>SW</td>
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</tr>
<tr>
<td>28.0</td>
<td>S18</td>
<td>60/0.5</td>
<td>37</td>
<td>1.2</td>
<td>80</td>
<td>-</td>
<td>SW</td>
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<tr>
<td>29.3</td>
<td>S19</td>
<td>50/0.3</td>
<td>43</td>
<td>1.3</td>
<td>100</td>
<td>-</td>
<td>SW</td>
<td>-</td>
<td>-12.0</td>
<td>Bottom of borehole at 29.3 feet.</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS
ENGINEERS FIELD BORING LOG

BORING NO.  ST-6
FORM NO:  D-481
(12/89)
REPRODUCE LOCALLY
PROJECT NAME  SEPTA Levittown Station  COUNTY  Bucks
PROJECT LOCATION  
STATION  
OFFSET FROM CENTERLINE  
NORTHING  307,420.73'  
EASTING  2,788,311.75'
STATE RT. NO.  
SECT. SECTOR  
SEGMENT SEGMENT  
INSPECTOR  H. Fenton  
CHECKED BY  A. Sheth
EQUIPMENT USED  Ingersoll Rand SQ A300 Truck Rig with Donut Hammer
DRILLING METHODS  HSA, Continuous SS Sampling
CASING: SIZE:  
DEPTH: 26.6'  
WATER:  
CHECKED BY:  A. Sheth
DATE:  3/7/08  
DEPTH:  7.5'  
TIME:  
DATE:  2/6/08
DATE:  2/5/08
O.G. ELEV.  16.3
O.G. ELEV.  16.3

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./</th>
<th>TYPE/CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/</th>
<th>TORVANE (TSF)</th>
<th>UCS AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
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<tbody>
<tr>
<td>0.0</td>
<td>S1</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>sm</td>
<td>m</td>
<td></td>
<td></td>
<td>Silty SAND with gravel (sm), brown to brown, moist, dense to very dense</td>
<td>Except where indicated, PID reading for all other samples is zero.</td>
</tr>
<tr>
<td>1.5</td>
<td>S2</td>
<td>17</td>
<td>15</td>
<td>20</td>
<td>sm</td>
<td>m</td>
<td></td>
<td></td>
<td>PID reading at auger opening is 0.4 ppm for 10' of auger in ground</td>
<td>PID reading at auger opening is 0.25 ppm for 16' of auger in ground</td>
</tr>
<tr>
<td>3.0</td>
<td>S3</td>
<td>16</td>
<td>14</td>
<td>53</td>
<td>PP 2.5</td>
<td>ml</td>
<td>m</td>
<td></td>
<td>Sandy SILT (ml), brown, moist, medium dense</td>
<td>PID reading at auger opening is 0.4 ppm for 10' of auger in ground</td>
</tr>
<tr>
<td>4.5</td>
<td>S4</td>
<td>10</td>
<td>14</td>
<td>73</td>
<td>PP 2.5</td>
<td>ml</td>
<td>m</td>
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<td>S5: PID = 36 ppm</td>
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<tr>
<td>6.0</td>
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<td>52</td>
<td>36</td>
<td>53</td>
<td>ml</td>
<td>m</td>
<td></td>
<td>S6: PID &gt; 50 ppm</td>
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<tr>
<td>7.5</td>
<td>S6</td>
<td>39</td>
<td>32</td>
<td>47</td>
<td>gm</td>
<td>m</td>
<td>w</td>
<td>S7: 0.0'</td>
<td>Silty Sandy GRAVEL with clay (gm), brown, wet, very dense</td>
<td></td>
</tr>
<tr>
<td>9.0</td>
<td>S7</td>
<td>50/0.3</td>
<td>32</td>
<td>0</td>
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<td></td>
<td>S8: PID = 3.5 ppm</td>
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<td>1.5</td>
<td>S8</td>
<td>3</td>
<td>2</td>
<td>27</td>
<td>sm</td>
<td>w</td>
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<td>Silty SAND (sm), brown, wet, loose to medium dense</td>
<td>S9: PID = 4 ppm</td>
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<tr>
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<td>S9</td>
<td>8</td>
<td>15</td>
<td>47</td>
<td>sm</td>
<td>w</td>
<td></td>
<td></td>
<td>GRAVEL with sand and silt (gw), brown, wet, very dense</td>
<td>S10: PID = 2 ppm</td>
</tr>
<tr>
<td>13.5</td>
<td>S10</td>
<td>10</td>
<td>50/0.5</td>
<td>60</td>
<td>sw</td>
<td>w</td>
<td></td>
<td></td>
<td>G1: 0.0'</td>
<td>GRAVEL with sand and silt (gw), brown, wet, very dense</td>
</tr>
<tr>
<td>14.5</td>
<td>S11</td>
<td>44</td>
<td>49</td>
<td>60</td>
<td>gw</td>
<td>w</td>
<td></td>
<td></td>
<td>GRAVEL with sand and silt (gw), brown, wet, very dense</td>
<td>S12: PID = 2 ppm</td>
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<tr>
<td>15.0</td>
<td>S12</td>
<td>40</td>
<td>50/0.5</td>
<td>60</td>
<td>gw</td>
<td>w</td>
<td></td>
<td></td>
<td>GR1: 0.0'</td>
<td>GRAVEL with sand and silt (gw), brown, wet, very dense</td>
</tr>
<tr>
<td>18.0</td>
<td>S13</td>
<td>50/0.5</td>
<td>32</td>
<td>0</td>
<td>gp</td>
<td>w</td>
<td></td>
<td></td>
<td>S14: PID = 2 ppm</td>
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NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/ TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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<td></td>
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<td>GRAVEL with sand and silt (gp), brown, wet, very dense (continued)</td>
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<tr>
<td>21.9</td>
<td>S15</td>
<td>50/0.4</td>
<td>0.5'</td>
<td>56</td>
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<td></td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<td></td>
</tr>
<tr>
<td>22.8</td>
<td>S16</td>
<td>50/0.3</td>
<td>0.3'</td>
<td>100</td>
<td>gp</td>
<td></td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.0</td>
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<td></td>
</tr>
<tr>
<td>24.2</td>
<td>S17</td>
<td>50/0.2</td>
<td>0.0'</td>
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<td>S18</td>
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<td>gp</td>
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<td></td>
</tr>
<tr>
<td>27.0</td>
<td>S19</td>
<td>34</td>
<td>0.6'</td>
<td>40</td>
<td>sp</td>
<td></td>
<td>w</td>
<td>SAND with gravel (sp), brown, wet, very dense</td>
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<tr>
<td>28.5</td>
<td>S20</td>
<td>28</td>
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<td>33</td>
<td>sp</td>
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<td>--</td>
<td></td>
<td></td>
<td></td>
<td>Bottom of borehole at 30.0 feet.</td>
<td></td>
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</tbody>
</table>

NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
## Engineers Field Boring Log

**Project Name:** SEPTA Levittown Station  
**County:** Bucks  
**Boring No.:** ST-7  
**Date:** 1/28/08

### Station Details
- **North:** 307,711.46'  
- **East:** 2,788,398.74'  
- **Inspector:** H. Fenton  
- **Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer  
- **Drilling Methods:** HSA, Continuous SS Sampling

### Check Details
- **Checked by:** A. Sheth  
- **Date:** 3/7/08  
- **Depth:** 9.0'  
- **Date:** 1/31/08

### Comments
- Checked = No Recorded Water Reading Measurements

### Observation Form
- **Sample No./Type/Core Run:**  
- **Blows/0.5 Ft. on Sampler:**  
- **Recovery:**  
- **Pocket Pent/Torvane (TSF):**  
- **USCS:**  
- **AASHTO:**  
- **H2O Content:**  
- **Description:**  
- **Remarks:**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No./Type/Core Run</th>
<th>Blows/0.5 Ft. on Sampler</th>
<th>Recovery</th>
<th>Pocket Pent/Torvane (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>S1</td>
<td>4</td>
<td>67</td>
<td>sm</td>
<td></td>
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<td>Silty SAND (sm), brown, moist, medium dense</td>
<td>PID reading for all samples is zero.</td>
</tr>
<tr>
<td>1.5</td>
<td>S2</td>
<td>10</td>
<td>1.0'</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>S3</td>
<td>5</td>
<td>0.3'</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>Sandy SILT (ml), brown, moist, loose</td>
<td>14.5</td>
</tr>
<tr>
<td>4.5</td>
<td>S4</td>
<td>6</td>
<td>1.1'</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>Silty SAND (SM), brown, moist to wet, medium dense to very dense</td>
<td>13.0</td>
</tr>
<tr>
<td>6.0</td>
<td>S5</td>
<td>5</td>
<td>1.4'</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.5</td>
<td>S6</td>
<td>5</td>
<td>1.3'</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>9.0</td>
<td>S7</td>
<td>4</td>
<td>0.9'</td>
<td>-</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10.5</td>
<td>S8</td>
<td>12</td>
<td>1.0'</td>
<td>-</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0</td>
<td>S9</td>
<td>15</td>
<td>1.1'</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.5</td>
<td>S10</td>
<td>22</td>
<td>0.8'</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.0</td>
<td>S11</td>
<td>28</td>
<td>1.1'</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td>SAND with gravel and silt (sw), brown, wet, very dense</td>
<td>2.5</td>
</tr>
<tr>
<td>16.5</td>
<td>S12</td>
<td>34</td>
<td>0.4'</td>
<td>-</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.0</td>
<td>S13</td>
<td>60/0.5</td>
<td>0.5'</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Notes
- **Draw Stratification Lines at the approximate boundary between soil types for this boring location and show depths**

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Form No: D-481  
Reproduce Locally  

date: 1/28/08

---

**Engineers Field Boring Log**

Project Name: SEPTA Levittown Station  
County: Bucks  

Boring No.: ST-7  
Date: 1/28/08  

Sample No./Type/Core Run | Blows/0.5 Ft. on Sampler | Recovery | Pocket Pent/Torvane (TSF) | USCS | AASHTO | H2O Content | Description | Remarks |
---|---|---|---|---|---|---|---|---|
0.0 | S1 | 4 | 67 | sm |      |        |            | Silty SAND (sm), brown, moist, medium dense | PID reading for all samples is zero. |
1.5 | S2 | 10 | 1.0' | - |      |        |            |             |         |
3.0 | S3 | 5 | 0.3' | - |      |        |            | Sandy SILT (ml), brown, moist, loose | 14.5 |
4.5 | S4 | 6 | 1.1' | - |      |        |            | Silty SAND (SM), brown, moist to wet, medium dense to very dense | 13.0 |
6.0 | S5 | 5 | 1.4' | - |      |        |            |             |         |
7.5 | S6 | 5 | 1.3' | - |      |        |            |             |         |
9.0 | S7 | 4 | 0.9' | - |      |        |            |             |         |
10.5 | S8 | 12 | 1.0' | - |      |        |            |             |         |
12.0 | S9 | 15 | 1.1' | - |      |        |            |             |         |
13.5 | S10 | 22 | 0.8' | - |      |        |            |             |         |
15.0 | S11 | 28 | 1.1' | - |      |        |            | SAND with gravel and silt (sw), brown, wet, very dense | 2.5 |
16.5 | S12 | 34 | 0.4' | - |      |        |            |             |         |
18.0 | S13 | 60/0.5 | 0.5' | - | sw |        |            |             |         |
19.5 | | 24 | 57 | sw |        |        |            |             |         |
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/ TORVANE (TSF)</th>
<th>USCS</th>
<th>ASTM/TC</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.9</td>
<td>S14</td>
<td>40</td>
<td>0.8'</td>
<td>-</td>
<td>SW</td>
<td>W</td>
<td></td>
<td>SAND with gravel and silt (sw), brown, wet, very dense (continued)</td>
<td></td>
</tr>
<tr>
<td>21.0</td>
<td>-</td>
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</tr>
<tr>
<td>21.5</td>
<td>S15</td>
<td>60/0.5</td>
<td>0.4'</td>
<td>80</td>
<td>SW</td>
<td>w</td>
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</tr>
<tr>
<td>22.5</td>
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</tr>
<tr>
<td>23.0</td>
<td>S16</td>
<td>60/0.5</td>
<td>0.5'</td>
<td>100</td>
<td>SW</td>
<td>w</td>
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</tr>
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<td>24.0</td>
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</tr>
<tr>
<td>24.5</td>
<td>S17</td>
<td>60/0.5</td>
<td>0.0'</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>24.5</td>
<td>Bottom of borehole at 24.5 feet.</td>
<td>-7.0</td>
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</tbody>
</table>

Bottom of borehole at 24.5 feet.
### Engineers Field Boring Log

**Project Name:** SEPTA Levittown Station  
**Project Location:**  
**Station:** 307,495.38'  
**Offset From Centerline:**  
**NORTHING:** 2,788,375.63'  
**EASTING:**  
**State Rt. No.:**  
**County:** Bucks  
**Inspector:** H. Fenton  
**Date:** 2/5/08  
**Time:** --  
**Depth:** 28.5'  
**Water Depth:** 8.5'  
**Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer  
**Drilling Methods:** HSA, Continuous SS Sampling

#### Depths

<table>
<thead>
<tr>
<th>Depth (FT)</th>
<th>Sample No./Core Run</th>
<th>Sample Recovery</th>
<th>Pocket Pent/Torvane (TSF)</th>
<th>USC/Asst</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
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<tbody>
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**Note:** Draw stratification lines at the approximate boundary between soil types for this boring location and show depths.
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<th>SAMPLE NO./ TYPECORE RUN</th>
<th>BLOW/S 0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/ TORVANE (TSP)</th>
<th>USCS</th>
<th>AASH/TO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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<td>52/0.2</td>
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<td>-</td>
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<td>w</td>
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<td>23</td>
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<td>w</td>
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<td>sp</td>
<td>w</td>
<td>Bottom of borehole at 29.6 feet.</td>
<td>-13.3</td>
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**NOTE:** DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
## Engineers Field Boring Log

### Project Details
- **Project Name**: SEPTA Levittown Station
- **County**: Bucks
- **Station**: 307,759.13' NORTHING, 2,788,449.44' EASTING
- **State Rt. No.**:
- **Offset from Centerline**:
- **Drillers Name/Company**: J. Kurzuynawski/JBD
- **Equipment Used**: Ingersoll Rand SQ A300 Truck Rig with Donut Hammer
- **Drilling Methods**: HSA, Continuous SS Sampling

### Description of Soil Layers

<table>
<thead>
<tr>
<th>Depth (Ft)</th>
<th>Sample No.</th>
<th>Type/Core Run</th>
<th>Blows/0.5 Ft. on Sampler</th>
<th>Recovery (%)</th>
<th>Recovery (%)</th>
<th>Pocket Penetration (TFI)</th>
<th>RQD (%)</th>
<th>POCKET PENT/TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
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<tr>
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<td>S1</td>
<td></td>
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<td></td>
<td>sm</td>
<td></td>
<td>m</td>
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<td>Silty SAND (SM), brown, moist, loose to medium dense</td>
<td>PID reading for all samples is zero.</td>
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### Additional Notes
- **Date**: 1/31/08
- **Time**: --
- **Remarks**: Draw stratification lines at the approximate boundary between soil types for this boring location and show depths.
<table>
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<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/ CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (FL)</th>
<th>RECOVERY (%)</th>
<th>POCKET PENET./ TURVANE (TSF)</th>
<th>USCS</th>
<th>AASHO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
**Engineers Field Boring Log**

**Project Name:** SEPTA Levittown Station  
**County:** Bucks

**Drilling Methods:** HSA, Continuous SS Sampling

**Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer

**Inspected By:** H. Fenton  
**Drilled By:** J. Kurzuynawski/JBD  
**Checked By:** A. Sheth

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**Table:**

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<th>Depth (Ft)</th>
<th>Sample No./Type/Core Run</th>
<th>Blows/0.5 Ft. on Sampler</th>
<th>Recovery (%)</th>
<th>Recovery (%)</th>
<th>Pockett Pend/Torvane (TSF)</th>
<th>UCS</th>
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<th>Description</th>
<th>Remarks</th>
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**Note:** Draw stratification lines at the approximate boundary between soil types for this boring location and show depths.
**ENGINEERS FIELD BORING LOG**

**PROJECT NAME:** SEPTA Levittown Station  
**COUNTY:** Bucks

**STATION:**  
**OFFSET FROM CENTERLINE:**  
**NORTHING:** 307,596.44'  
**EASTING:** 2,788,455.93'

**RECOVERY (Ft.)**

<table>
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<tr>
<th>Depth (ft)</th>
<th>Sample No./Type/Core Run</th>
<th>Blows/0.5 ft. On Sampler</th>
<th>Recovery (FL)</th>
<th>Recovery (%)</th>
<th>RQD (%)</th>
<th>POCKET PENT/TORVANE (TSF)</th>
<th>AASHTO</th>
<th>HO Content</th>
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<td>Bottom of borehole at 29.3 feet.</td>
<td>-13.1</td>
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</table>

**NOTE:** DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
# Engineers Field Boring Log

**Project Name:** SEPTA Levittown Station  
**County:** Bucks  
**Station:**  
**Offset from Centerline:**  
**North:** 307,840.58'  
**Easting:** 2,788,515.85'  
**Inspector:** H. Fenton  
**Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer  
**Drilling Methods:** HSA, Continuous SS Sampling

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Sample No./Type/Core Run</th>
<th>Blows/0.5 ft. on Sampler</th>
<th>Recovery (%)/Pocket Pent/Torvane (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>Water</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
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<td>Silty SAND (SM), brown, moist, loose to medium dense</td>
<td>PID reading for all samples is zero.</td>
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<td>SM</td>
<td>m</td>
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**Note:** Draw stratification lines at the approximate boundary between soil types for this boring location and show depths.
<table>
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<tr>
<th>SAMPLE NO./</th>
<th>DEPTH (FT)</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>POCKET PENT/TORVANE (TSP)</th>
<th>RECOVERY (%)</th>
<th>RECOVERY (%O.G.)</th>
<th>AASHTO</th>
<th>USCS</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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<td>Silty SAND with gravel (sm), brown, wet, medium dense to very dense (continued)</td>
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NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
### ENGINEERS FIELD BORING LOG

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/ TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O CONTENT</th>
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<th>REMARKS</th>
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<td>m</td>
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**NOTE:** DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/ CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/ TORVANE (TSF)</th>
<th>USCS/ AASHO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
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<td>w</td>
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<td>Sandy GRAVEL (gw), brown, wet, very dense (continued)</td>
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<td>S15</td>
<td>11</td>
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<td>80</td>
<td>gw</td>
<td>w</td>
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<tr>
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<td>1.2'</td>
<td>gw</td>
<td>w</td>
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<td>w</td>
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<td>0.5'</td>
<td>gw</td>
<td>w</td>
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<tr>
<td>28.5</td>
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<td>Bottom of borehole at 28.5 feet.</td>
<td>12.7</td>
</tr>
</tbody>
</table>

NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./TYPE/Core RUN</th>
<th>BLOWS/0.5 FT ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O content</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>S1</td>
<td>31</td>
<td>30</td>
<td>26</td>
<td></td>
<td></td>
<td>m</td>
<td>Silty SAND (SM), brown, moist, medium dense to very dense</td>
<td>PID reading for all samples is zero.</td>
</tr>
<tr>
<td>1.5</td>
<td>S2</td>
<td>28</td>
<td>12</td>
<td>12</td>
<td></td>
<td></td>
<td>m</td>
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<td>3.0</td>
<td>S3</td>
<td>12</td>
<td>12</td>
<td>9</td>
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<td>m</td>
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<td>4.5</td>
<td>S4</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
<td></td>
<td>m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>S5</td>
<td>40</td>
<td>50/0.4</td>
<td>70</td>
<td>gm</td>
<td></td>
<td>m</td>
<td>Sandy GRAVEL with silt (gw), brown, moist to wet, very dense</td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td>S6</td>
<td>18</td>
<td>33</td>
<td>33</td>
<td></td>
<td></td>
<td>m-w</td>
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</tr>
<tr>
<td>9.0</td>
<td>S7</td>
<td>26</td>
<td>50/0.5</td>
<td>80</td>
<td>gw</td>
<td></td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>S8</td>
<td>50/0.5</td>
<td>50/0.5</td>
<td>100</td>
<td>gw</td>
<td></td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.0</td>
<td>S9</td>
<td>30</td>
<td>50/0.4</td>
<td>100</td>
<td>gm</td>
<td></td>
<td>w</td>
<td></td>
<td></td>
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<tr>
<td>13.5</td>
<td>S10</td>
<td>50/0.2</td>
<td>50/0.2</td>
<td>50</td>
<td>sp</td>
<td></td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.0</td>
<td>S11</td>
<td>50/0.2</td>
<td>50/0.2</td>
<td>50</td>
<td>sp</td>
<td></td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.5</td>
<td>S12</td>
<td>50/0.5</td>
<td>50/0.5</td>
<td>20</td>
<td>sp</td>
<td></td>
<td>w</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.0</td>
<td>S13</td>
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</table>

NOTE: DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
<table>
<thead>
<tr>
<th>Sample No./Type/Core Run</th>
<th>Depth (FT)</th>
<th>Bore Blows/0.5 FT. on Sampler</th>
<th>Recovery (%)</th>
<th>Recovery (FL)</th>
<th>Pocket Penet. Torvane (TSP)</th>
<th>Hydrometer Test</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>S15</td>
<td>21.0</td>
<td>18</td>
<td>60</td>
<td>40</td>
<td>0.9'</td>
<td>sp</td>
<td>-</td>
<td>Sandy GRAVEL with silt (gw), brown, moist to wet, very dense (continued)</td>
</tr>
<tr>
<td></td>
<td>22.5</td>
<td>40</td>
<td>0.8'</td>
<td>50</td>
<td>100</td>
<td>gw</td>
<td>w</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23.3</td>
<td>60/0.3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>S17</td>
<td>25.0</td>
<td>54</td>
<td>70</td>
<td>60/0.5</td>
<td>0.7'</td>
<td>gw</td>
<td>w</td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>S18</td>
<td>26.0</td>
<td>55/0.5</td>
<td>80</td>
<td>50</td>
<td>0.4'</td>
<td>gw</td>
<td>w</td>
<td></td>
</tr>
<tr>
<td></td>
<td>27.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>S19</td>
<td>27.3</td>
<td>50/0.3</td>
<td>0</td>
<td>0</td>
<td>0.0'</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>28.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>S20</td>
<td>30.0</td>
<td>9</td>
<td>80</td>
<td>28</td>
<td>1.2'</td>
<td>sp</td>
<td>w</td>
<td>Bottom of borehole at 30.0 feet.</td>
</tr>
</tbody>
</table>

**NOTE:** DRAW STRATIFICATION LINES AT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES FOR THIS BORING LOCATION AND SHOW DEPTHS.
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./CORE RUN</th>
<th>TYPE/Core Run</th>
<th>SIZE/TYPE/RECOVERY (%)</th>
<th>H.O. CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>3</td>
<td>4</td>
<td>8</td>
<td>sp-sm</td>
<td>Poorly-Graded SAND with silt (SP-SM), brown, dry to wet, medium dense to very dense</td>
<td>Hole relocated 10.9' away from track (from original location)</td>
</tr>
<tr>
<td>2.0</td>
<td>12</td>
<td>9</td>
<td>10</td>
<td>sp-sm</td>
<td>S-2: Black with Cinders And Coal Pieces</td>
<td>Gravel is mostly round</td>
</tr>
<tr>
<td>4.0</td>
<td>12</td>
<td>11</td>
<td>8</td>
<td>sp-sm</td>
<td>S-4: Lab classified</td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td>12</td>
<td>15</td>
<td>16</td>
<td>-</td>
<td>S-5: Increase in gravel content</td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td>26</td>
<td>36</td>
<td>28 (core &amp; sampler)</td>
<td>sp-sm</td>
<td>8.0': Introduce water to advance roller bit</td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>9</td>
<td>0.9</td>
<td>24</td>
<td>w</td>
<td>S-6: Silty SAND with gravel (SM), brown, wet, dense to very dense (alluvial)</td>
<td>Gravel is mostly round</td>
</tr>
<tr>
<td>12.0</td>
<td>15</td>
<td>10</td>
<td>-</td>
<td>w</td>
<td>S-8: Cobble obstruction</td>
<td></td>
</tr>
<tr>
<td>12.5</td>
<td>100</td>
<td>0.4</td>
<td>80</td>
<td>-</td>
<td>S-7: Cobble obstruction</td>
<td></td>
</tr>
<tr>
<td>14.0</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>16.0</td>
<td>3</td>
<td>0.6</td>
<td>30</td>
<td>w</td>
<td>S-9: Cobble obstruction</td>
<td></td>
</tr>
<tr>
<td>18.0</td>
<td>29</td>
<td>63</td>
<td>40</td>
<td>sm</td>
<td>S-10: Cobble obstruction</td>
<td></td>
</tr>
</tbody>
</table>
**ENGINEERS FIELD BORING LOG**

**PROJECT NAME**  SEPTA Levittown Station  **COUNTY**  Bucks

**INSPECTOR**  H. Fenton  **DRILLERS NAME/COMPANY**  J. Kurzuynawski/JBD

**EQUIPMENT USED**  Ingersoll Rand SO A300 Truck Rig with Donut Hammer

**DRILLING METHODS**  Mud Rotary, Continuous SS Sampling

**CASING**  4" (OD)  **DEPTH**  30.0'  **WATER**  DEPTH:  10.0'  **TIME**:  DATE:  9/5/08

**CHECKED BY**  M. McCullough  **DATE**:  9/9/08  **DEPTH**:  **DATE**:  

**NOT ENCOUNTERED**  

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./TYPE/CORE RUN</th>
<th>BLOWSS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (F.L.)</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>22.0</td>
<td>S-11</td>
<td></td>
<td>40</td>
<td>0.8'</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td>Poorly-Graded SAND with silt and gravel (SP-SM), brown, wet, very dense, (alluvial)</td>
<td>S-12, S-13, S-14: Lab classified</td>
</tr>
<tr>
<td>24.0</td>
<td>S-12</td>
<td></td>
<td>40</td>
<td>0.8'</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td>S-12, S-13, S-14: Lab classified</td>
<td></td>
</tr>
<tr>
<td>26.0</td>
<td>S-13</td>
<td></td>
<td>40</td>
<td>0.8'</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td>S-15: Boulder obstruction</td>
<td></td>
</tr>
<tr>
<td>28.0</td>
<td>S-15</td>
<td></td>
<td>40</td>
<td>0.8'</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td>S-15: Boulder obstruction</td>
<td></td>
</tr>
<tr>
<td>30.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>From 30' to 33', roller bit advance faster, layer is mostly sand</td>
<td></td>
</tr>
<tr>
<td>33.0</td>
<td>S-16</td>
<td></td>
<td>30</td>
<td>0.6'</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td>Silty SAND with gravel (SM), brown, wet, medium dense to very dense, (alluvial)</td>
<td></td>
</tr>
<tr>
<td>35.0</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>S-16, S-17: Lab classified</td>
<td></td>
</tr>
<tr>
<td>38.0</td>
<td>S-17</td>
<td></td>
<td>45</td>
<td>0.9'</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
<td>Bottom of borehole at 40.0 feet.</td>
<td></td>
</tr>
<tr>
<td>40.0</td>
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<td></td>
<td></td>
<td>Bottom of borehole at 40.0 feet.</td>
<td></td>
</tr>
<tr>
<td>BORE NO.</td>
<td>TU-2</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>DATE:</td>
<td>START 9/8/08</td>
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<tr>
<td>END:</td>
<td>9/10/08</td>
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</tr>
<tr>
<td>O.G.</td>
<td>ELEV. 17.5</td>
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</tr>
<tr>
<td>SHEET 1 OF 2</td>
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</tbody>
</table>

**ENGINEERS FIELD BORING LOG**

**PROJECT NAME**  
SEPTA Levittown Station

**COUNTY**  
Bucks

**STATION**  
H. Fenton

**INSPECTOR**  
H. Fenton

**EQUIPMENT USED**  
Ingersoll Rand SO A300 Truck Rig with Donut Hammer

**DRILLING METHODS**  
Mud Rotary, Continuous SS Sampling

**DEPTH (FT)**  

<table>
<thead>
<tr>
<th>BORE NO.</th>
<th>Sample No.</th>
<th>Type/Core Run</th>
<th>Recovery</th>
<th>Recovery (%)</th>
<th>Pocket Penetration/Torque (TSF)</th>
<th>USC's</th>
<th>AASHTO</th>
<th>H2O Content</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>TU-2</td>
<td>S-1</td>
<td>6-20-26-38</td>
<td>0.6'</td>
<td>30</td>
<td>gm</td>
<td></td>
<td></td>
<td></td>
<td>Silty GRAVEL with sand (gm), brown to dark brown, moist, dense, with cinders (FILL)</td>
<td>Boring advances through rail road ballast</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.0'</td>
<td>El. 15.5'</td>
</tr>
<tr>
<td></td>
<td>S-2</td>
<td>47-14-7-7</td>
<td>1.2'</td>
<td>60</td>
<td>ML</td>
<td></td>
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<td></td>
<td>Sandy SILT (ML), brown, moist, medium dense to dense</td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.0'</td>
<td>El. 15.5'</td>
</tr>
<tr>
<td></td>
<td>S-3</td>
<td>5-6-6-19</td>
<td>0.9'</td>
<td>45</td>
<td>ML</td>
<td></td>
<td></td>
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<td>S-2, S-3: Lab classified</td>
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<td></td>
<td></td>
<td></td>
<td>6.0'</td>
<td>El. 15.5'</td>
</tr>
<tr>
<td></td>
<td>S-4</td>
<td>18-17-15-20</td>
<td>1.3'</td>
<td>65</td>
<td>ml</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8.0'</td>
<td>El. 9.5'</td>
</tr>
<tr>
<td></td>
<td>S-5</td>
<td>16-31-30-90</td>
<td>1.4'</td>
<td>70</td>
<td>sm</td>
<td></td>
<td></td>
<td></td>
<td>Silty SAND with gravel (sm), brown, moist, very dense</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10.0'</td>
<td>El. 7.5'</td>
</tr>
<tr>
<td></td>
<td>S-6</td>
<td>7-70/0.4</td>
<td>0.3'</td>
<td>33</td>
<td>sp</td>
<td></td>
<td></td>
<td></td>
<td>Poorly-Graded SAND with silt and gravel (SP-SM), brown, wet, medium dense to very dense</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12.0'</td>
<td>El. 7.5'</td>
</tr>
<tr>
<td></td>
<td>S-7</td>
<td>29-18-20-32</td>
<td>0.5'</td>
<td>25</td>
<td>sp</td>
<td></td>
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<td></td>
<td></td>
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<td>14.0'</td>
<td>El. 7.5'</td>
</tr>
<tr>
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<td>S-8</td>
<td>12-12-13-20</td>
<td>0.8'</td>
<td>40</td>
<td>sp</td>
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<td></td>
<td></td>
<td>16.0'</td>
<td>El. 7.5'</td>
</tr>
<tr>
<td></td>
<td>S-9</td>
<td>6-6-6-7</td>
<td>0.7'</td>
<td>35</td>
<td>SP-SM</td>
<td></td>
<td></td>
<td></td>
<td>S-9: Lab classified</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18.0'</td>
<td>El. 7.5'</td>
</tr>
<tr>
<td></td>
<td>S-10</td>
<td>5-6-57-29</td>
<td>0.5'</td>
<td>25</td>
<td>sp</td>
<td></td>
<td></td>
<td></td>
<td>S-10: Cobble obstruction</td>
<td></td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>20.0</td>
<td>El. 2.0'</td>
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<table>
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<tr>
<th>WATER</th>
<th>20.0</th>
<th>2.0</th>
<th>0.0</th>
<th>4.0</th>
<th>6.0</th>
<th>8.0</th>
<th>10.0</th>
<th>12.0</th>
<th>14.0</th>
<th>16.0</th>
<th>18.0</th>
<th>20.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPTH</td>
<td>28.0'</td>
<td>10.3'</td>
<td>2.0'</td>
<td>4.0'</td>
<td>6.0'</td>
<td>8.0'</td>
<td>10.0'</td>
<td>12.0'</td>
<td>14.0'</td>
<td>16.0'</td>
<td>18.0'</td>
<td>20.0'</td>
</tr>
</tbody>
</table>

**O.G.**

**ELEV.**

**DATE:** 9/10/08

**TIME:**

**ENDED ON:**

**NOTE:**

---

**NOT ENCOUNTERED**
### Engineers Field Boring Log

**Project Name:** SEPTA Levittown Station  
**County:** Bucks

**SR:**  
**SECT.:**  
**Segment:**  
**Offset:**  
**Station:**  
**Offset from Centerline:**

**Inspector:** H. Fenton  
**Drillers Name/Company:** J. Kurzuynawski/JBD

**Equipment Used:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer

**Drilling Methods:** Mud Rotary, Continuous SS Sampling

**Casing:** 4” (OD)  
**Depth:** 28.0’  
**Water:** Depth: 10.3’  
**Time:**  
**Date:** 9/10/08

**Checked By:** M. McCullough  
**Date:** 9/29/08  
**Depth:**  
**Time:**  
**Date:**

---

<table>
<thead>
<tr>
<th>Sample No./Type of Core Run</th>
<th>Recovery (Ft)</th>
<th>Density</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-11</td>
<td>43, 31, 58</td>
<td>0.7’</td>
<td>gp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-12</td>
<td>23, 52, 54</td>
<td>1.1’</td>
<td>gm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-13</td>
<td>18, 29</td>
<td>1.0’</td>
<td>gp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-14</td>
<td>16, 28, 50</td>
<td>0.8’</td>
<td>gp</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-15</td>
<td>43, 34, 55</td>
<td>0.8’</td>
<td>gp</td>
</tr>
</tbody>
</table>

---

**O.G. END:** 9/10/08  
**Elev.: 17.5’**

---
### ENGINEERS FIELD BORING LOG

**BORING NO.:** TU-3  
**DATE:** 9/4/08  
**O.G.:** 18.1

**PROJECT NAME:** SEPTA Levittown Station  
**COUNTY:** Bucks

**SR:**  
**SECT.:**  
**SEGMENT:**  
**OFFSET:**

**STATION:**  
**OFFSET FROM CENTERLINE:**

**INSPECTOR:** H. Fenton  
**DRILLERS NAME/COMPANY:** J. Kurzuynawski/JBD

**EQUIPMENT USED:** Ingersoll Rand SQ A300 Truck Rig with Donut Hammer

**DRILLING METHODS:** Mud Rotary, Continuous SS Sampling

**CASING: SIZE:** 4" (OD)  
**DEPTH:** 32.0'  
**WATER: DEPTH:** 11.0'  
**TIME:**  
**DATE:**

**CHECKED BY:** M. McCullough  
**DATE:** 9/9/08  
**DEPTH:**  
**TIME:**  
**DATE:**

**NOT ENCOUNTERED**

---

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY (%)</th>
<th>POCKET PENT/TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHO H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>S-1</td>
<td>8</td>
<td>40</td>
<td>sm</td>
<td></td>
<td></td>
<td>Silty SAND with gravel (SM), brown, dry to moist, medium dense to dense S-1: increase in gravel content</td>
<td>Round gravel</td>
</tr>
<tr>
<td>2.0</td>
<td>S-2</td>
<td>9</td>
<td>14</td>
<td>16</td>
<td>24</td>
<td>0.8'</td>
<td>S-2: increase in silt content S-2: Lab classified</td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td>S-3</td>
<td>5</td>
<td>11</td>
<td>8</td>
<td>7</td>
<td>0.3'</td>
<td>Silty SAND with gravel (SM), brown, dry to moist, medium dense to dense</td>
<td>Round gravel</td>
</tr>
<tr>
<td>6.0</td>
<td>S-4</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>0.7'</td>
<td>Silty SAND with gravel (SM), brown, dry to moist, medium dense to dense</td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td>S-5</td>
<td>13</td>
<td>18</td>
<td>14</td>
<td>15</td>
<td>0.9'</td>
<td>Silty SAND with gravel (SM), brown, dry to moist, medium dense to dense</td>
<td></td>
</tr>
<tr>
<td>10.0</td>
<td>S-6</td>
<td>8</td>
<td>17</td>
<td>23</td>
<td>26</td>
<td>1.1'</td>
<td>Silty SAND with gravel (SM), brown, dry to moist, medium dense to dense</td>
<td></td>
</tr>
<tr>
<td>12.0</td>
<td>S-7</td>
<td>16</td>
<td>13</td>
<td>8</td>
<td>10</td>
<td>0.8'</td>
<td>Sandy SILT (ML), brown, wet, medium dense, (alluvial) S-7, S-8: Lab classified</td>
<td></td>
</tr>
<tr>
<td>14.0</td>
<td>S-8</td>
<td>8</td>
<td>8</td>
<td>11</td>
<td>10</td>
<td>0.3'</td>
<td>Sandy SILT (ML), brown, wet, medium dense, (alluvial) S-7, S-8: Lab classified</td>
<td></td>
</tr>
<tr>
<td>16.0</td>
<td>S-9</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>9</td>
<td>1.3'</td>
<td>S-9: increase in sand content</td>
<td></td>
</tr>
<tr>
<td>18.0</td>
<td>S-10</td>
<td>20</td>
<td>33</td>
<td>38</td>
<td>50</td>
<td>1.0'</td>
<td>Silty GRAVEL with sand (GM), brown, wet, very dense S-10, S-11: Lab classified</td>
<td></td>
</tr>
</tbody>
</table>
**PROJECT NAME**  SEPTA Levittown Station  
**COUNTY**  Bucks  
**DRILLERS NAME/COMPANY**  J. Kurzuynawski/JBD  
**EQUIPMENT USED**  Ingersoll Rand SO A300 Truck Rig with Donut Hammer  
**CASING: SIZE**  4" (OD)  
**DEPTH**  32.0'  
**WATER: DEPTH**  11.0'  
**DATE: 9/4/08**  
**NOT ENCOUNTERED**

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO.</th>
<th>RECOVERY (FL)</th>
<th>POCKET PENT/ TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>O.G.</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.0</td>
<td>S-11</td>
<td>85</td>
<td>0.5'</td>
<td>GM</td>
<td>w</td>
<td></td>
<td>Mix of angular and round gravel, but mostly round</td>
<td></td>
</tr>
<tr>
<td>22.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>23.5</td>
<td>S-12</td>
<td>35</td>
<td>0.5'</td>
<td>GM</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.0</td>
<td>S-13</td>
<td>22</td>
<td>0.4'</td>
<td>GM</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.0</td>
<td>S-14</td>
<td>62</td>
<td>0.4'</td>
<td>GM</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.0</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>30.0</td>
<td>S-15</td>
<td>31</td>
<td>0.7'</td>
<td>GM</td>
<td>w</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33.0</td>
<td>S-16</td>
<td>16</td>
<td>0.8'</td>
<td>SM</td>
<td>w</td>
<td></td>
<td>Silty SAND (SM), brown, wet, dense to very dense, (alluvial)</td>
<td>S-16: Lab classified</td>
</tr>
<tr>
<td>35.0</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38.0</td>
<td>S-17</td>
<td>110/0</td>
<td>0.1'</td>
<td>SM</td>
<td>w</td>
<td></td>
<td></td>
<td>S-17: Cobble obstruction</td>
</tr>
<tr>
<td>38.1</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>DEPTH (FT)</td>
<td>SAMPLE NO./ TYPE/CORE RUN</td>
<td>BLOWS/0.5 FT ON SAMPLER</td>
<td>RECOVERY (%)</td>
<td>POCKET PENT/TORVANE (TSF)</td>
<td>USCS</td>
<td>AASHTO</td>
<td>H2O CONTENT</td>
<td>DESCRIPTION</td>
</tr>
<tr>
<td>------------</td>
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<td>---------</td>
<td>-------------</td>
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</tr>
<tr>
<td>43.0</td>
<td>S-18</td>
<td>32</td>
<td>44</td>
<td>50</td>
<td>1.3'</td>
<td>-</td>
<td>w</td>
<td>SW-SM</td>
</tr>
<tr>
<td>43.0</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>43.0'</td>
</tr>
<tr>
<td>45.0</td>
<td>S-19</td>
<td>26</td>
<td>29</td>
<td>23</td>
<td>1.4'</td>
<td>-</td>
<td>w</td>
<td>SW-SM</td>
</tr>
<tr>
<td>50.0</td>
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</tr>
<tr>
<td>53.0</td>
<td>S-20</td>
<td>27</td>
<td>25</td>
<td>28</td>
<td>1.4'</td>
<td>-</td>
<td>w</td>
<td>sw-sm</td>
</tr>
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<td>55.0'</td>
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</tr>
<tr>
<td>60.0</td>
<td>S-21</td>
<td>16</td>
<td>28</td>
<td>31</td>
<td>1.9'</td>
<td>-</td>
<td>w</td>
<td>SM</td>
</tr>
</tbody>
</table>

**S-20: from 53.7' to 54.3' clayey to silty sand**

**S-18, S-19: Lab classified**

**S-21: Lab classified**

**Well-graded SAND with silt (SW-SM), gray, wet, very dense**

**S-18, S-19: Lab classified**
<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLE NO./ TYPE/ CORE RUN</th>
<th>BLOWS/0.5 FT. ON SAMPLER</th>
<th>RECOVERY</th>
<th>POCKET PENT/ TORVANE (TSF)</th>
<th>USCS</th>
<th>AASHTO</th>
<th>H2O CONTENT</th>
<th>DESCRIPTION</th>
<th>REMARKS</th>
</tr>
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<tbody>
<tr>
<td>63.0</td>
<td>S-22</td>
<td>15</td>
<td>100</td>
<td></td>
<td>SM</td>
<td></td>
<td></td>
<td>63.0'</td>
<td>El. -44.9' Silty SAND (SM), brown, moist, very dense, (weathered rock) S-22, S-23: Lab classified</td>
</tr>
<tr>
<td>64.5</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>69.8</td>
<td>S-23</td>
<td>28</td>
<td>72</td>
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<td>SM</td>
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</tr>
<tr>
<td>73.2</td>
<td>S-24</td>
<td>100/0.2</td>
<td>100</td>
<td></td>
<td>SM</td>
<td></td>
<td></td>
<td>Bottom of borehole at 73.2 feet.</td>
<td></td>
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