WOODLAND AVENUE OVER MEDIA ELWYN REGIONAL RAIL LINE BRIDGE REPLACEMENT

STANDARD CONSTRUCTION SPECIFICATIONS AND SPECIAL PROVISION - ADDENDUM 3

VOLUME 2 OF 3

JANUARY 4, 2017

Submitted by:
Pennoni Associates Inc.
in association with
American Geotechnical & Environmental Services, Inc.
Hatch Mott MacDonald
# WOODLAND AVENUE OVER MEDIA ELWYN REGIONAL RAIL LINE BRIDGE REPLACEMENT

## CONSTRUCTION SPECIFICATIONS AND SPECIAL PROVISIONS

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PART 1– GENERAL

1.01 DESCRIPTION

A. The work specified in this section consists of the demolition, removal, disposal and salvage of existing construction from the areas as shown on the Contract Drawings and as required to execute the work of this Contract.

B. The work includes all incidental and miscellaneous items not specified under another section but required for the work of this Section, whether or not specifically referred to herein.

C. Demolition work includes, but is not necessarily limited to, the demolition and removal of the following:
   1. Bridge abutments, wingwalls, and associated spread footing foundations.
   2. Bridge superstructure including: trolley rail, bridge barrier and rail/fence, concrete deck, concrete sidewalk, girders, cross-bracing, diaphragms, and all embedded utilities.

D. All non-regulated materials resulting from demolition work, except those noted herein or otherwise determined by the Project Manager, shall become the property of the Contractor and shall be removed from the limits of the project site.

E. Demolition debris that contains controlled material is to be disposed of properly. Provide Chain-of-Custody and proof of proper disposal for all controlled material.

F. Rubbish and debris shall be removed from the project site daily unless the Project Manager approves otherwise so as not to allow accumulation. Demolished materials that cannot be removed daily shall be stored in areas designated and approved by the Project Manager.

G. Demolition work includes removal of existing construction that may interfere with the installation of new construction work, whether or not indicated on the Contract Drawings or specified herein. Removal of items not indicated on the Contract Drawings or specified herein but considered necessary to allow proper installation of new work shall be brought to the attention of the Project Manager prior to demolition.

1.02 RELATED SECTIONS

A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02200 – Earthwork
D. Section 02220 – Excavation, Backfill, and Compaction
E. Section 02075 – Treatment and Handling of Materials with Lead-Based Paint
F. Section 02085 - Treatment and Handling of Materials with Asbestos
G. Section 13090 - Underpinning of Existing Retaining Wall and Building Foundations

1.03 SUBMITTALS

A. Submit the following in accordance with provisions of Section 01300:
1. Procedures proposed for the accomplishment of demolition work, in writing, for each construction phase to the Project Manager for review prior to start of work. The procedures shall provide for safe conduct of the work, uninterrupted progress of SEPTA's railroad operations, protection of pedestrians and of property which is to remain undisturbed and uninterrupted, and coordination with other work in progress. The procedures shall include a detailed description of the methods and equipment to be used for each operation, the sequence of operations, durations, and the location and construction of barricades, fences and temporary work. Include in schedule coordination for shut-off, capping, and continuation of utility services as required. Meet scheduling and phasing requirements of Section 01010 regarding Construction Staging.

2. Proposed method for protecting railroad track and SEPTA infrastructure below the bridge from debris that may fall from the bridge during demolition.

3. Proposed dust control measures.

4. Proposed noise control measures.

5. Inventory of items to be removed and salvaged.

6. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by demolition operations.

7. Record drawings at project closeout according to Section 01700, Contract Closeout. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

8. Proof of legal disposal: Landfill records for record purposes indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

9. Plans and details of the proposed temporary shielding/protection system to prevent any damage to the existing catenary wires and communication and signal wires (C&S) during the existing bridge demolition and construction of the bridge substructure and superstructure.

B. Permits:

1. Obtain permits, as required from the City of Philadelphia, Department of Licenses and Inspections, and other local or State agencies.

2. Furnish the Project Manager with copies of the demolition permit(s). Post permits as required.

3. Arrange for the disposal of debris resulting from the demolition, to locations outside the project site and obtain written permits and releases from the owners of the property where the materials will be deposited. Submit to the Project Manager two (2) copies of each permit and of releases from each property owner absolving SEPTA from any and all responsibility in connection with the disposal of the debris.

1.04 QUALITY ASSURANCE

A. Demolition:

1. Demolish materials and equipment as shown on the Contract Drawings and described herein, and remove debris from the site. Use such methods as required to complete the work within the limitations of governing regulations. Use experienced demolition personnel.
**Selective Demolition - Bridge**

**100% Submission**

**WOODLAND AVENUE OVER MEDIA**

**ELWYN REGIONAL RAIL LINE**

**BRIDGE REPLACEMENT**

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a. The Contractor shall immediately notify SEPTA of any damaged facilities or equipment and confirm damage in writing within 24 hours.

b. Proceed with demolition in a systematic manner.

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**B. Pollution Controls:**

1. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rise to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
   
a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

b. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by SEPTA or governing authorities. Return adjacent areas to condition existing prior to start of work.

2. Comply with National Emission Standards for Hazardous Air Pollutants (NESHAPs) emission standards during wet demolition.

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**C. Demolition Firm Qualifications:** Engage an experienced firm that has successfully completed demolition work similar to that indicated for this Project.

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**D. Regulatory Requirements:** Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

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**E. Comply with the City of Philadelphia Building Code demolition requirements as amended to date.**

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**G. Comply with OSHA Standards as applicable.**

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**H. Comply with NFPA-241 - Safeguarding construction alteration and demolition operations.**

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**I. Comply with PADOT Publication 408M, Section 202.**

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**1.05 DEFINITIONS**

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain SEPTA’s property.

B. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

C. Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Project Manager, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original location.

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**1.06 PROJECT CONDITIONS**

A. Explosives: Do not bring explosives to the site or use any explosives under any circumstances.

B. The work, including demolition activities, will be accomplished in discrete phases.

C. The construction staging plans shown on the Contract Drawings have been developed to maintain service for utilities throughout the period of construction. The plans show a suggested construction sequence. The plans are not intended to restrict the scope of the work, or to relieve the Contractor from its obligations to minimize interference with normal operations. Refer to the Contract Drawings for the suggested construction staging.
D. Occupancy:
   1. Safety of SEPTA operations, patrons and employees is paramount. Demolition work that would interfere with or be hazardous to the operation of trains shall only occur during approved shutdown or outage periods.

E. Protections:
   1. Environmental Protection: All work and Contractor operations shall comply with the requirements of Section 01060.
   2. Protection of Existing Work: Before beginning any cutting or demolition work, carefully survey the existing work and examine the Contract Drawings and Specifications and determine the full extent of the work. Take all necessary precautions to insure against damage to existing work both above and below ground to remain in place. Any damage to such work shall be repaired or the work replaced as approved by the Project Manager at no additional cost to SEPTA.
   3. In accordance with Section 01580, furnish and maintain temporary signs, barricades, flashing lights and flagperson(s), if required by the work, or as directed by the Project Manager, and remove same upon completion of the work.
   4. Provide shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities remain in accordance with the provisions of Section 02160 and as indicated on the Contract Drawings.
   5. Erect debris containment curtains from the sides of the structure.
   6. Furnish, install and maintain shielding as needed to protect the public and the train operators from harm due to demolition or welding operations.

F. Observe all State and local safety and health ordinances, especially those regarding fire hazards and pest control.

G. SEPTA assumes no responsibility for actual condition of elements to be demolished. Conditions existing at the time of inspection for bidding purposes will be maintained by SEPTA as far as practical.

H. Damages:
   1. Promptly repair damages caused to adjacent facilities by demolition operations as directed by the Project Manager and at no cost to SEPTA.

I. Utility Services:
   1. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
      a. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

PART 2 – PRODUCTS

This Part not used.
PART 3 – EXECUTION

3.01 GENERAL
   A. Protect track running rail and ties from impact of falling debris and prevent track ballast from being fouled with fine material.
   B. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
   C. Protect Public During Working Period: Ensure the safe passage of persons around the area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, utilities, and persons.
   D. Maintain existing utilities indicated to remain in service, and protect against damage during demolition operations. Verify that utility services have been terminated and sealed before demolition operations commence.
   E. The use of explosives will not be permitted.
   F. Cut sections of existing structures constructed of reinforced or unreinforced concrete, steel or other metals, timber, masonry or other materials to the limit lines indicated with a saw or cutting tool specifically designed for that purpose in order to provide a reasonably smooth surface and to prevent damage to the remaining structure. Core drill openings through concrete and masonry work. Do not cut with hammer and chopping tools. Use water and adequate ventilation to control dust.
   G. All metals, timber, concrete and masonry removed shall become the property of the Contractor, unless otherwise noted herein or determined by the Project Manager, and shall be hauled, at the Contractor’s sole expense, off the project site. The Contractor will be required to repair or replace in kind at his own expense and as directed by the Project Manager, adjacent structures, utilities or other property not designated for removal that have been damaged by the Contractor’s removal operations.
   H. Provide adequate protection to prevent damage to pipes, conduits, wires, cables or other utilities above or below ground which are not designated for removal.
   I. Verify all existing circuits applications prior to removal of any existing circuitry.
   J. Refer to Section 01060 for dust control requirements.
   K. Inform the public and attend any public meeting necessary during demolition or other construction activities where the noise level is excessively high. Control noise levels in accordance with the requirements of Section 01060.

3.02 REMOVAL OF MATERIALS WITH LEAD-BASED PAINT
   A. Comply with the provisions of Section 02075.

3.03 REMOVAL OF ASBESTOS CONTAINING MATERIALS
   A. Comply with the provisions of Section 02085.

3.04 UNDERPINNING OF ADJACENT STRUCTURES.
   A. Comply with the provisions of Section 13090.
3.05 EXISTING UTILITY SERVICES
A. Prior to the commencement of demolition operations, make all necessary arrangements with the proper authorities for the turning off and the disconnection of all public utilities required in connection with demolition operations, including electric, gas, telephone, sewer, water, and other facilities encountered, unless otherwise directed.
B. Where special procedures for relocation, disconnection, and/or removal of meters, sealing and/or plugging of service pipes, etc., are required by local authorities, or are shown on the Contract Drawings, the work shall be performed in accordance with such requirements.
C. Bear all costs, including fees to utility companies and/or other agencies, resulting from this incidental work, and furnish the Project Manager with receipts showing proof of payment.

3.06 DEMOLITION REQUIREMENTS
A. Obtain written permission from all adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.
B. Maintain egress and access at all times and conduct operations with minimum interference to public or private accesses.
C. Demolition shall immediately cease and the Project Manager notified if adjacent structures appear to be in danger. Demolition shall not resume until directed in writing by the Project Manager.
D. Leave the work site in a clean and finished condition upon completion of the work.

3.07 DEMOLITION OPERATIONS
A. Identify, disconnect and cap utilities within the demolition areas.
B. Existing communications and signal cable is supported from the bridge superstructure and abutments. During demolition operations, exercise extreme care in protecting these cables. Some of these cables are protected by asbestos insulation and extreme caution must be practiced when working in the vicinity of these cables.
C. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
D. Adjacent facilities to remain shall be cleaned of dust, dirt, and debris caused by demolition operations, as directed by the Project Manager or governing authorities. Return adjacent areas to condition existing prior to the start of the work.
E. Perform demolition completely and remove materials from the site. Use such methods as required to complete the work within the limitations of governing regulations. Demolish concrete and masonry in small sections. Small structures may be removed intact only when acceptable to the Project Manager and approved by the authorities having jurisdiction.
F. Excavation, backfilling and compaction of trenches and excavations resulting from the work under this Section shall be in accordance with Section 02200.

3.08 DISPOSAL OF DEMOLISHED MATERIALS
A. Remove from the site debris, rubbish, and other materials resulting from the demolition operations.
B. Burning of removed materials from demolished structures will not be permitted on the site.
C. Transport demolished materials and properly dispose of them off the site.
D. All structures designated for demolition under this Contract shall be released to the Contractor and shall become the exclusive property of the Contractor for complete demolition at the site. All existing equipment, material, fixtures, etc., shall become the property of the Contractor. No sale of salvaged items shall be conducted on site.

E. Dispose of all demolished materials mixed with lead-based paint in accordance with PADEP requirements and the provisions of Section 01060.

F. Dispose of all demolished materials mixed with asbestos in accordance with PADEP requirements and the provisions of Section 01060.

3.09 DEMOLITION SCHEDULE
A. Items and material to be removed are indicated on the Contract Drawings.
B. Items to be removed and reinstalled are indicated on the Contract Drawings.

END OF SECTION 02070
SECTION 02072
SELECTIVE DEMOLITION - ROADWAY

PART 1– GENERAL

1.01 DESCRIPTION
A. The work specified in this section consists of the demolition, removal, disposal and salvage of existing construction from the areas as shown on the Contract Drawings and as required to execute the work of this Contract.

B. The work includes all incidental and miscellaneous items not specified under another section but required for the work of this Section, whether or not specifically referred to herein.

C. Demolition work includes, but is not necessarily limited to, the demolition and removal of the following:
   1. Concrete sidewalk
   2. Concrete and granite curbs
   3. Concrete trolley slab
   4. Bituminous asphalt

D. All non-regulated materials resulting from demolition work, except those noted herein or otherwise determined by the Project Manager, shall become the property of the Contractor and shall be removed from the limits of the project site.

E. Demolition debris that contains controlled material is to be disposed of properly. Provide Chain-of-Custody and proof of proper disposal for all controlled material.

F. Rubbish and debris shall be removed from the project site daily unless the Project Manager approves otherwise so as not to allow accumulation. Demolished materials that cannot be removed daily shall be stored in areas designated and approved by the Project Manager.

G. Demolition work includes removal of existing construction that may interfere with the installation of new construction work, whether or not indicated on the Contract Drawings or specified herein. Removal of items not indicated on the Contract Drawings or specified herein but considered necessary to allow proper installation of new work shall be brought to the attention of the Project Manager prior to demolition.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02120 – Clearing and Grubbing
D. Section 02200 – Earthwork
E. Section 02220 – Excavation, Backfill, and Compaction
F. Section 02225 – Class 1, Class 1A, and Class 1B Excavation
G. Section 02270 – Soil Erosion and Sedimentation Control
H. Section 02085 - Treatment and Handling of Materials with Asbestos
I. Section 13090 - Underpinning of Existing Retaining Wall and Building Foundations

1.03 SUBMITTALS
A. Submit the following in accordance with provisions of Section 01300:

1. Procedures proposed for the accomplishment of demolition work, in writing, for each construction phase to the Project Manager for review prior to start of work. The procedures shall provide for safe conduct of the work, uninterrupted progress of SEPTA’s railroad operations, protection of pedestrians and of property which is to remain undisturbed and uninterrupted, and coordination with other work in progress. The procedures shall include a detailed description of the methods and equipment to be used for each operation, the sequence of operations, durations, and the location and construction of barricades, fences and temporary work. Include in schedule coordination for shut-off, capping, and continuation of utility services as required. Meet scheduling and phasing requirements of Section 01010 regarding Construction Staging.

2. Proposed dust control measures.

3. Proposed noise control measures.

4. Inventory of items to be removed and salvaged.

5. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by demolition operations.

6. Record drawings at project closeout according to Section 01700, Contract Closeout. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

7. Proof of legal disposal: Landfill records for record purposes indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

B. Permits:

1. Obtain permits, as required from the City of Philadelphia, Department of Licenses and Inspections, and other local or State agencies.

2. Furnish the Project Manager with copies of the demolition permit(s). Post permits as required.

3. Arrange for the disposal of debris resulting from the demolition, to locations outside the project site and obtain written permits and releases from the owners of the property where the materials will be deposited. Submit to the Project Manager two (2) copies of each permit and of releases from each property owner absolving SEPTA from any and all responsibility in connection with the disposal of the debris.

### 1.04 QUALITY ASSURANCE

A. Demolition:

1. Demolish materials and equipment as shown on the Contract Drawings and described herein, and remove debris from the site. Use such methods as required to complete the work within the limitations of governing regulations. Use experienced demolition personnel.
   
   a. The Contractor shall immediately notify SEPTA of any damaged facilities or equipment and confirm damage in writing within 24 hours.
   
   b. Proceed with demolition in a systematic manner

B. Pollution Controls:
1. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rise to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
   a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
   b. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by SEPTA or governing authorities. Return adjacent areas to condition existing prior to start of work.

2. Comply with National Emission Standards for Hazardous Air Pollutants (NESHAPs) emission standards during wet demolition.

C. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed demolition work similar to that indicated for this Project.

D. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

E. Comply with the City of Philadelphia Building Code demolition requirements as amended to date.


G. Comply with OSHA Standards as applicable.

H. Comply with NFPA-241 - Safeguarding construction alteration and demolition operations.

I. Comply with PennDOT Publication 408M, Section 202.

1.05 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain SEPTA’s property.

B. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in locations indicated.

C. Existing to Remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Project Manager, items may be removed to a suitable, protected storage location during demolition and then cleaned and reinstalled in their original location.

1.06 PROJECT CONDITIONS

A. Explosives: Do not bring explosives to the site or use any explosives under any circumstances.

B. Prohibited Equipment: The use of a hydro-hammer or any other similar type of equipment for the removal of existing paving shall be prohibited due to the great possibility of damage to existing underground structures (such as water and gas mains and services and laterals) and to the possible excessive breakage or overbreakage of existing paving.

C. Steel Plates: When steel plates are used for decking over trenches, the Contractor shall paint the following information on each of the plates for identification to assist the Police Department in the event of an emergency:

1. S.D.

2. CONTRACTOR’S NAME

3. The overall height and width of each letter shall be four (4) inches by four (4) inches and the painted letter shall be three-fourths (3/4) inch in width. The information shall
be placed in the center of the plate. The paint shall be white and of good quality and durability. The Contractor shall repaint the letters as necessary if the paint becomes obliterated during the contract period. The lettering shall be clear and legible.

D. Street Signs: Any existing street signs disturbed by the construction that are not to be replaced shall be reset by the Contractor. No additional or separate compensation will be allowed for this work.

E. City Property: All material and objects located in the street Right-of-Way or on the structure which are the property of the City of Philadelphia or of which the owner is not known, including but not limited to steel plates, signage & poles, street lighting, traffic signals, and other miscellaneous hardware and appurtenances must be returned to the City by the Contractor and transported to a specific location at the direction of the Engineer at no additional cost and without separate payment.

F. The work, including demolition activities, will be accomplished in discrete phases.

G. The construction staging plans shown on the Contract Drawings have been developed to maintain service for utilities throughout the period of construction. The plans show a suggested construction sequence. The plans are not intended to restrict the scope of the work, or to relieve the Contractor from its obligations to minimize interference with normal operations. Refer to the Contract Drawings for the suggested construction staging.

H. Occupancy:
   1. Safety of SEPTA operations, patrons and employees is paramount. Demolition work that would interfere with or be hazardous to the operation of trains shall only occur during approved shutdown or outage periods.

I. Protections:
   1. Environmental Protection: All work and Contractor operations shall comply with the requirements of Section 01060.
   2. Protection of Existing Work: Before beginning any cutting or demolition work, carefully survey the existing work and examine the Contract Drawings and Specifications and determine the full extent of the work. Take all necessary precautions to insure against damage to existing work both above and below ground to remain in place. Any damage to such work shall be repaired or the work replaced as approved by the Project Manager at no additional cost to SEPTA.
   3. In accordance with Section 01580, furnish and maintain temporary signs, barricades, flashing lights and flagperson(s), if required by the work, or as directed by the Project Manager, and remove same upon completion of the work.

J. Observe all State and local safety and health ordinances, especially those regarding fire hazards and pest control.

K. SEPTA assumes no responsibility for actual condition of elements to be demolished. Conditions existing at the time of inspection for bidding purposes will be maintained by SEPTA as far as practical.

L. Damages:
   1. Promptly repair damages caused to adjacent facilities by demolition operations as directed by the Project Manager and at no cost to SEPTA.

M. Utility Services:
   1. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
a. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

PART 2 – PRODUCTS
This Part not used.

PART 3 – EXECUTION

3.01 GENERAL
A. Conduct demolition operations and the removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
B. Protect Public During Working Period: Ensure the safe passage of persons around the area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, utilities, and persons.
C. Maintain existing utilities indicated to remain in service, and protect against damage during demolition operations. Verify that utility services have been terminated and sealed before demolition operations commence.
D. The use of explosives will not be permitted.
E. All metals, timber, concrete and masonry removed shall become the property of the Contractor, unless otherwise noted herein or determined by the Project Manager, and shall be hauled, at the Contractor’s sole expense, off the project site. The Contractor will be required to repair or replace in kind at his own expense and as directed by the Project Manager, adjacent structures, utilities or other property not designated for removal that have been damaged by the Contractor’s removal operations.
F. Provide adequate protection to prevent damage to pipes, conduits, wires, cables or other utilities above or below ground which are not designated for removal.
G. Verify all existing circuits applications prior to removal of any existing circuitry.
H. Refer to Section 01060 for dust control requirements.
I. Inform the public and attend any public meeting necessary during demolition or other construction activities where the noise level is excessively high. Control noise levels in accordance with the requirements of Section 01060.

3.02 REMOVAL OF ASBESTOS CONTAINING MATERIALS
A. Comply with the provisions of Section 02085.

3.03 UNDERPINNING OF ADJACENT STRUCTURES.
A. Comply with the provisions of Section 13090.
3.04 EXISTING UTILITY SERVICES

A. Prior to the commencement of demolition operations, make all necessary arrangements with the proper authorities for the turning off and the disconnection of all public utilities required in connection with demolition operations, including electric, gas, telephone, sewer, water, and other facilities encountered, unless otherwise directed.

B. Where special procedures for relocation, disconnection, and/or removal of meters, sealing and/or plugging of service pipes, etc., are required by local authorities, or are shown on the Contract Drawings, the work shall be performed in accordance with such requirements.

C. Bear all costs, including fees to utility companies and/or other agencies, resulting from this incidental work, and furnish the Project Manager with receipts showing proof of payment.

3.05 DEMOLITION REQUIREMENTS

A. Obtain written permission from all adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

B. Maintain egress and access at all times and conduct operations with minimum interference to public or private accesses.

C. Demolition shall immediately cease and the Project Manager notified if adjacent structures appear to be in danger. Demolition shall not resume until directed in writing by the Project Manager.

D. Leave the work site in a clean and finished condition upon completion of the work.

3.06 DEMOLITION OPERATIONS

A. Identify, disconnect and cap utilities within the demolition areas.

B. Existing communications and signal cable is supported from the bridge superstructure and abutments. During demolition operations, exercise extreme care in protecting these cables. Some of these cables are protected by asbestos insulation and extreme caution must be practiced when working in the vicinity of these cables.

C. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

D. Adjacent facilities to remain shall be cleaned of dust, dirt, and debris caused by demolition operations, as directed by the Project Manager or governing authorities. Return adjacent areas to condition existing prior to the start of the work.

E. Perform demolition completely and remove materials from the site. Use such methods as required to complete the work within the limitations of governing regulations.

F. Class 1, Class 1A, and Class 1B excavation resulting from the work under this Section shall be in accordance with Section 02225.

3.07 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove from the site debris, rubbish, and other materials resulting from the demolition operations.

B. Burning of removed materials from demolished structures will not be permitted on the site.

C. Transport demolished materials and properly dispose of them off the site.
D. All structures designated for demolition under this Contract shall be released to the Contractor and shall become the exclusive property of the Contractor for complete demolition at the site. All existing equipment, material, fixtures, etc., shall become the property of the Contractor. No sale of salvaged items shall be conducted on site.

E. Dispose of all demolished materials mixed with asbestos in accordance with PADEP requirements and the provisions of Section 01060.

F. The Contractor shall take care in removing the existing granite curb along Woodland Avenue during the demolition of the roadway. The existing granite curb shall be protected after being removed and surrendered to the Philadelphia Streets Department.

3.08 DEMOLITION SCHEDULE

A. Items and material to be removed are indicated on the Contract Drawings.

B. Items to be removed and reinstalled are indicated on the Contract Drawings.

END OF SECTION 02072
SECTION 02075
TREATMENT AND HANDLING OF MATERIALS WITH LEAD-BASED PAINT

PART 1 – GENERAL

1.01 DESCRIPTION
   A. The work specified in this Section consists of treatment and handling of bridge materials, typically steel structural members, which have been previously painted with lead-based paint.
   B. This work is not intended to be an abatement of lead-based paint. However, testing during the design phase of the project has identified locations on the bridge that have lead-based paint. Therefore, the Contractor is advised to provide safe work practices during all construction activities that cause burning or grinding existing steel, specifically but not limited to demolition.

1.02 RELATED WORK
   A. Section 01060 – Regulatory Requirements and Safety.
   B. Section 01100 – Special Project Procedures.
   C. Section 01300 – Submittals.
   D. Section 02070 – Selective Demolition.
   E. Section 05120 – Structural Steel.

1.03 REFERENCES
   A. The publications listed below form a part of this specification to the extent referenced. The publications are referred within the text by the basic designation only.
   B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
      1. ANSI Z88.2 (1992) Respiratory Protection
   C. CODE OF FEDERAL REGULATIONS (CFR)
      1. 29 CFR 1926.21 Safety Training and Education
      2. 29 CFR 1926.55 Gases, Vapors, Fumes, Dusts, and Mists
      3. 29 CFR 1926.59 Hazard Communication
      4. 29 CFR 1926.62 Lead Exposure in Construction
      5. 29 CFR 1926.103 Respiratory Protection
      6. 40 CFR 268 Land Disposal Restrictions
      7. 40 CFR 745 Lead; Requirements for Lead-Based Paint Activities
   D. Commonwealth of Pennsylvania Department of Environmental Protection (PADEP).
      1. Title 34 Labor and Industry, Chapter 203: Lead-Based Paint Occupation Accreditation and Certification.
E. SEPTA “Management of Lead Paint on SEPTA Construction Projects” (Document number 3001, Rev 8/09). This document is available from SEPTA on request.

1.04 DEFINITIONS

A. Action Level - Employee exposure, without regard to use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air averaged over an 8 hour period in an occupational/industrial environment.

B. Area Sampling - Sampling of lead concentrations within the lead control area and inside the physical boundaries which is representative of the airborne lead concentrations but is not collected in the breathing zone of personnel.

C. Competent Person (CP) - As used in this section refers to a person employed by the Contractor who is trained in the recognition and control of lead hazards in accordance with current federal, State, and local regulations. An industrial hygienist or a safety professional certified for comprehensive practice by the American Board of Industrial Hygiene as a CIH or by the Board of Certified Safety Professionals as a CSP is the best choice.

D. Contaminated Room - Room for removal of contaminated personal protective equipment (PPE).

E. Decontamination Shower Facility - That facility that encompasses a clean clothing storage room, and a contaminated clothing storage and disposal rooms, with a shower facility in between.

F. Eight-Hour Time Weighted Average (TWA) - Airborne concentration of lead to which an employee is exposed, averaged over an 8 hour workday as indicated in 29 CFR 1926.62.

G. High Efficiency Particulate Air (HEPA) Filter Equipment - HEPA filtered vacuuming equipment with a UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron or larger size particles.

H. Lead - Metallic lead, inorganic lead compounds, and organic lead soaps.

I. Lead Containing Paint (LCP) - Protective or decorative coating which contains lead.

J. Lead Control Area - An enclosed area or structure, constructed as a temporary containment equipped with HEPA filtered local exhaust, which prevents the spread of lead dust, paint chips, or debris existing as a condition of lead based paint removal operations. The lead control area is also isolated by physical boundaries to prevent unauthorized entry of personnel.

K. Lead Permissible Exposure Limit (PEL) - Fifty micrograms per cubic meter of air as an 8 hour time weighted average as determined by 29 CFR 1926.62. If an employee is exposed for more than eight hours in a work day, the PEL shall be determined by the following formula: PEL (micrograms/cubic meter of air) = 400/No. hrs worked per day

L. Personal Sampling - Sampling of airborne lead concentrations within the breathing zone of an employee to determine the 8 hour time weighted average concentration in accordance with 29 CFR 1926.62. Samples shall be representative of the employees' work tasks. Breathing zone shall be considered an area within a hemisphere, forward of the shoulders, with a radius of six to nine inches and centered at the nose or mouth of an employee.

M. Physical Boundary - Area physically roped or partitioned off around an enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean the same as "outside lead control area but inside boundary."
1.05 SUBMITTALS

A. Manufacturer's Catalog Data
   1. Data composed of catalog cuts, brochures, circulars, specifications and product
data, and printed information in sufficient detail and scope to verify compliance
with requirements of the contract documents. A type of product data.
      a. Vacuum filters
      b. Respirators

B. Instructions
   1. Preprinted material describing installation of a product, system, or material,
including special notes and Material Safety Data Sheets, if any concerning
impedances, hazards, and safety precautions. A type of product data.
      a. Chemicals and equipment
      b. Materials
      c. Material safety data sheets for all chemicals

C. Statements
   1. A document, required of the Contractor, or through the Contractor by way of a
supplier, installer, manufacturer, or other lower tier contractor, the purpose of
which is to further the quality or orderly progression of a portion of the work by
documenting procedures, acceptability of methods or personnel, qualifications, or
other verification of quality. A type of shop drawing.
      a. Qualifications of CP
      b. Testing laboratory and consultant qualifications
      c. Lead containing paint removal plan including CP approval (signature, date,
and certification number)
      d. Rental equipment notification
      e. Respiratory protection program
      f. Hazard communication program
      g. EPA approved hazardous waste treatment or disposal facility for lead
disposal
      h. Hazardous waste management plan
   2. Qualifications of CP - Submit name, address, and telephone number of the CP
selected to perform responsibilities specified in paragraph titled “Competent
Person (CP) Responsibilities.” Provide previous experience of the CP. Submit
proper documentation that the CP is trained in accordance with Federal, State,
and Local laws.
   3. Testing Laboratory and Consultant - Submit the name, address, and telephone
number of the testing laboratory and consultant selected to perform the sampling,
testing, and reporting of airborne concentrations of lead. Use a laboratory
accredited under the EPA National Lead Laboratory Accreditation Program
(NLLAP) by either the American Association for Laboratory Accreditation (A2LA)
or the American Industrial Hygiene Association (AIHA) and that is successfully
participating in the Environmental Lead Proficiency Analytical Testing (ELPAT)
program to perform sample analysis. Use a consultant trained as a lead inspector
and risk assessor in accordance with 40 CFR 745.
   4. Lead Containing Paint Removal Plan (LCPRP) - Submit a detailed job-specific
plan of the work procedures to be used in the removal of LCP. The plan shall
include a sketch showing the location, size, and details of lead control areas,
location and details of decontamination facilities, viewing ports, and mechanical ventilation system. Include in the plan, eating, drinking, smoking and sanitary procedures, interface of trades, sequencing of lead related work, collected waste water and paint debris disposal plan, air sampling plan, respirators, personal protective equipment, and a detailed description of the method of containment of the operation to ensure that airborne lead concentrations of 30 micrograms per cubic meter of air and baseline lead dust concentrations are not reached or exceeded outside of the lead control area. Include occupational and environmental sampling, training and strategy, sampling methodology, frequency, duration of sampling, and qualifications of sampling personnel in the air sampling portion of the plan.

D. Field Test Reports
1. A written report which includes the findings of a test made at the job site, in the vicinity of the job site, or on a sample taken from the job site, on a portion of the work, during or after installation. The report must be signed by an authorized official of a testing laboratory or agency and must state the test was performed in accordance with the test requirements; state the test results; and indicate whether the material, product, or system has passed or failed the test. A type of shop drawing.
   a. Sampling results
2. Occupational and Environmental Sampling Results - Submit occupational and environmental sampling results to the Project Manager within three working days of collection, signed by the testing laboratory employee performing the analysis, the employee that performed the sampling, and the CP.

E. Certificates
1. Statements signed by responsible officials of a manufacturer of a product, system, or material attesting that the product, system, or material meet specified requirements. The statements must be dated after the award of this contract, name the project, and list the specific requirements which it is intended to address. A type of shop drawing.
   a. Vacuum filters

F. Records
1. Documentation to ensure compliance with an administrative requirement or to establish an administrative mechanism. A type of administrative submittal.
   a. Completed and signed hazardous waste manifest from treatment or disposal facility
   b. Certification of medical examinations
   c. Employee training certification

1.06 QUALITY ASSURANCE
A. Competent Person (CP) Responsibilities
1. Certify worker training is in accordance with all federal, State, and local requirements.
2. Review and approve lead based paint removal plan for conformance to the applicable referenced standards.
3. Continuously inspect lead containing paint removal work for conformance with the approved plan.
4. Perform air and wipe sampling.
5. Ensure work is performed in strict accordance with specifications at all times.

6. Control work to prevent hazardous exposure to human beings and to the environment at all times.

7. Certify the conditions of the work as called for elsewhere in this specification.

B. Training

1. Train each employee performing paint removal, disposal, and air sampling operations prior to the time of initial job assignment and annually thereafter, in accordance with 29 CFR 1926.21, 29 CFR 1926.62, and State and local regulations.

C. Training Certification - Submit a certificate for each employee, signed and dated by the approved training source, stating that the employee has received the required lead training.

D. Commonwealth of Pennsylvania Licensing - The Contractor, the on-site supervisor and the lead abatement workers shall hold current Pennsylvania certifications in accordance with Title 34 the Lead Occupation Accreditation and Certification Act (published November 8, 1997).

E. Respiratory Protection Program

1. Furnish each employee required to wear a negative pressure respirator or other appropriate type with a respirator fit test at the time of initial fitting and at least every six months thereafter as required by 29 CFR 1926.62.


F. Hazard Communication Program

1. Establish and implement a Hazard Communication Program as required by 29 CFR 1926.59.

G. Hazardous Waste Management

1. The Hazardous Waste Management Plan shall comply with applicable requirements of Federal, State, and Local hazardous waste regulations and address:

2. Identification and classification of hazardous wastes associated with the work.

3. Estimated quantities of wastes to be generated and disposed of.

4. Names and qualifications of each contractor that will be transporting, storing, treating, and disposing of the wastes. Include the facility location and operator and a 24-hour point of contact. Furnish two copies of EPA State and local hazardous waste permits, manifests, and EPA Identification numbers.

5. Names and qualifications (experience and training) of personnel who will be working on-site with hazardous wastes.

6. List of waste handling equipment to be used in performing the work, to include cleaning, volume reduction, and transport equipment.

7. Spill prevention, containment, and cleanup contingency measures including a health and safety plan to be implemented in accordance with 29 CFR 1926.62.

8. Work plan and schedule for waste containment, removal and disposal. Wastes shall be cleaned up and containerized daily.

9. Cost for hazardous waste disposal according to this plan.

H. Safety and Health Compliance

1. In addition to the detailed requirements of this specification, comply with laws, ordinances, rules, and regulations of Federal, State, and Local authorities
regarding removing, handling, storing, transporting, and disposing of lead waste materials. Comply with the applicable requirements of the current issue of 29 CFR 1926.62. Submit matters regarding interpretation of standards to the Project Manager for resolution before starting work. Where specification requirements and the referenced documents vary, the most stringent requirement shall apply.

I. Pre-Construction Conference
1. Along with the CP, meet with the Project Manager to discuss in detail the hazardous waste management plan and the lead based paint removal plan, including work procedures and precautions for the removal plan.

J. Quality Control Inspections
1. While performing lead-containing paint abatement work, the Contractor shall be subject to on-site inspections by SEPTA or SEPTA’s contracted inspection services. Work shall also be subject to inspection by Federal OSHA and EPA inspectors, Commonwealth of Pennsylvania Department of Labor and Industry and Department of Environmental Protection inspectors and City of Philadelphia building and/or health inspectors.

PART 2– PRODUCTS

2.01 EQUIPMENT
A. Respirators: Furnish appropriate respirators approved by the Occupational Safety and Health (OSHA) and the National Institute for Occupational Safety and Health (NIOSH), Department of Health and Human Services, for use in atmospheres containing lead dust. Respirators shall comply with the requirements of 29 CFR 1926.62.
B. Special Protective Clothing: Furnish personnel who will be exposed to lead-contaminated dust with proper disposable protective whole body clothing, head covering, gloves, and foot coverings as required by 29 CFR 1926.62. Dispose of reusable protective whole body clothing as hazardous waste after completion of the project. Furnish proper disposable plastic or rubber gloves to protect hands. Reduce the level of protection only after obtaining approval from the CP.
C. Rental Equipment Notification: If rental equipment is to be used during lead containing paint handling and disposal, notify the rental agency in writing concerning the intended use of the equipment. Furnish a copy of the written notification to the Project Manager.
D. Vacuum Filters: UL 586 labeled HEPA filters.
E. Equipment for SEPTA Personnel: Furnish the Project Manager with two complete sets of personal protective equipment (PPE) daily, as required herein, for entry into and inspection of the paint removal work within the lead controlled area. Personal protective equipment shall include disposable whole body covering, including appropriate foot, head, and hand protection and respiratory protection. PPE shall remain the property of the Contractor.

2.02 CHEMICALS
A. Submit applicable Material Safety Data Sheets for all chemicals used in paint removal work. Use the least toxic product approved by the Project Manager.

2.03 MATERIALS
A. Abrasive blasting materials shall meet the requirements of MIL-A-22262 for limits on chemical composition and hazardous material ingredients. The soluble metal content
and the total metal content shall not exceed values which would cause a material to be classified as a hazardous waste as specified in MIL-A-22262.

PART 3– EXECUTION

3.01 PROTECTION

A. Notification

1. The Contractor shall notify the Project Manager 20 days prior to the start of any paint removal work.

B. Lead Control Area Requirements

1. The Contractor shall establish a lead control area by completely enclosing the area or structure where lead containing paint removal operations will be performed.

2. The Contractor shall contain removal operations by the use of a negative pressure enclosure system with decontamination facilities and with HEPA filtered exhaust. For containment areas larger than 100 square feet install a minimum of two 1-foot square viewing ports. Locate ports to provide a view of the required work from the exterior of the enclosed contaminated area. Glaze ports with laminated safety glass.

C. Boundary Requirements

1. The Contractor shall provide physical boundaries around the lead control area by roping off the area designated in the work plan or providing curtains, portable partitions or other enclosures to ensure that airborne concentrations of lead will not reach 30 micrograms per cubic meter of air outside of the lead control area.

D. Decontamination Shower Facility

1. The Contractor shall provide clean and contaminated change rooms and shower facilities in accordance with this specification and 29 CFR 1926.62.

E. Personnel Protection

1. The Contractor personnel shall wear and use protective clothing and equipment as specified herein. Eating, smoking, or drinking or application of cosmetics is not permitted in the lead control area. No one will be permitted in the lead control area unless they have been appropriately trained and provided with protective equipment.

F. Warning Signs

1. The Contractor shall provide warning signs at approaches to lead control areas. Locate signs at such a distance that personnel may read the sign and take the necessary precautions before entering the area. Signs shall comply with the requirements of 29 CFR 1926.62.

3.02 WORK PROCEDURES

A. The Contractor shall perform removal of lead containing paint in accordance with approved lead based paint removal plan. The Contractor shall use procedures and equipment required to limit occupational and environmental exposure to lead when lead based paint is removed in accordance with 29 CFR 1926.62, except as specified herein. The contractor shall dispose of removed paint chips and associated waste in compliance with Environmental Protection Agency (EPA), Federal, State, and Local requirements.

1. Personnel Exiting Procedures
a. Whenever personnel exit the lead control area, they shall perform the following procedures and shall not leave the work place wearing any clothing or equipment worn during the work day:
b. Vacuum themselves off.
c. Remove protective clothing in the contaminated change room, and place them in an approved impermeable disposal bag.
d. Shower.
e. Change to clean clothes prior to leaving the physical boundary designated around the lead control area.

B. Air and Wipe Sampling

1. Air sample for lead in accordance with 29 CFR 1926.62 and as specified herein. Air and wipe sampling shall be performed by the CP.
   a. The CP shall be on the job site conducting the air and wipe sampling and inspecting the lead containing paint removal work to ensure that the requirements of the contract have been satisfied during the entire lead containing paint removal operation.
   b. The CP will collect personal air samples on employees who are anticipated to have the greatest risk of exposure as determined by the CP. In addition, the CP will collect air samples on at least twenty-five percent of the work crew or a minimum of two employees, whichever is greater, during each work shift.
   c. The CP will submit signed results of air samples, signed by the CP, within 72 hours after the air samples are taken. The CP will notify the Project Manager immediately of exposure to lead at or in excess of the action level of 30 micrograms per cubic meter of air outside of the lead control area.
   d. Before any work begins, the CP will collect and analyze baseline wipe samples in accordance with methods defined in Federal, State, and Local standards inside and outside of the physical boundary to assess the degree of dust contamination in the area prior to lead containing paint removal.

2. Air Sampling During Paint Removal Work
   a. The CP will conduct area air sampling daily, on each shift in which lead containing paint removal operations are performed, in areas immediately adjacent to the lead control area. The CP will conduct sufficient area monitoring to ensure unprotected personnel are not exposed at or above 30 micrograms per cubic meter of air. If 30 micrograms per cubic meter of air is reached or exceeded, stop work, correct the condition(s) causing the increased levels. Notify the Project Manager immediately, and determine if condition(s) require any further change in work methods. Removal work shall resume only after approval is given by the CP and the Project Manager. For outdoor operations, at least one air sample on each shift will be taken by the CP on the downwind side of the lead control area.

3. Lead Containing Paint Removal
   a. Manual or power sanding of bridge surfaces is not permitted. The Contractor shall provide methodology for removing LCP in work plan. The Contractor shall remove paint within the areas designated on the drawings in order to completely expose the substrate. The Contractor shall take whatever precautions necessary to minimize damage to the substrate.
b. Avoid flash rusting or other deterioration of the substrate. The Contractor shall provide surface preparations for painting in accordance with Section 09900, "Paints and Coatings".

c. The Contractor shall select paint removal processes to minimize contamination of work areas with lead-contaminated dust or other lead-contaminated debris/waste. The Contractor shall describe this paint removal process in the lead containing paint removal plan. The Contractor shall perform manual wet sanding and scraping to the maximum extent feasible.

4. Outdoor Lead Containing Paint Removal

a. The Contractor shall perform outdoor LCP removal as indicated in accordance with Federal, State, and Local regulations and in the work plan.

5. Air Sampling After Lead Containing Paint Removal

a. After the visual inspection, The CP will collect air samples inside and outside the lead control area to determine the airborne levels of lead inside and outside the work area.

C. Cleanup and Disposal

1. Cleanup

a. The Contractor shall maintain surfaces of the lead control area free of accumulations of paint chips and dust, restrict the spread of dust and debris and keep waste from being distributed over the work area. Do not dry sweep or use compressed air to clean up the area. At the end of each shift and when the paint removal operation has been completed, the Contractor shall clean the area of visible lead paint contamination by vacuuming with a HEPA filtered vacuum cleaner, wet mopping the area and wet wiping the area as indicated by the CP. The Contractor shall reclean areas showing dust or residual paint chips or debris. After visible dust, chips and debris is removed, the Contractor shall wet wipe and HEPA vacuum all surfaces in the work area. If adjacent areas become contaminated at any time during the work, the Contractor shall clean, visually inspect, and then the CP will wipe sample all contaminated areas. The CP will then certify in writing that the area has been cleaned of lead contamination before restarting work.

2. Certification

a. The CP will certify in writing that the final air samples collected inside and outside the lead control area are less than 30 micrograms per cubic meter of air; the respiratory protection used for the employees was adequate; the work procedures were performed in accordance with 29 CFR 1926.62 and 40 CFR 745; and that there were no visible accumulations of lead based paint and dust left in the work site. The Contractor shall not remove the lead control area or roped off boundary and warning signs prior to the Contracting Officer's acknowledgement of receipt of the CP certification.

3. Testing of Lead Containing Paint Residue and Used Abrasive

a. The Contractor shall test lead containing paint residue and used abrasive in accordance with 40 CFR 261 for hazardous waste.

4. Disposal

a. The Contractor shall collect lead-contaminated waste, scrap, debris, bags, containers, equipment, and lead-contaminated clothing which may produce airborne concentrations of lead particles. The Contractor shall label the containers in accordance with 29 CFR 1926.62 and 40 CFR 261. The Contractor shall dispose of lead-contaminated waste material at an EPA approved hazardous waste treatment, storage, or disposal facility.
b. The Contractor shall store waste materials in U.S. Department of Transportation (49 CFR 178) approved 55 gallon drums, properly label each drum to identify the type of waste (49 CFR 172) and the date the drum was filled. The Project Manager or an authorized representative will assign an area for interim storage of lead containing waste drums. Do not store hazardous waste drums in interim storage longer than 90 calendar days from the date affixed to each drum.

c. The Contractor shall handle, store, transport, and dispose lead or lead-contaminated waste in accordance with 40 CFR 260, 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, and 40 CFR 265 and comply with land disposal restriction notification requirements as required by 40 CFR 268.

d. Prior to the off-site transport and disposal of the paint removal waste, the waste description and weight must be recorded on a log. The log, which is to be maintained on site, shall also include the name of the transporter, the destination, and the date and time of departure.

e. The Contractor shall weigh the paint removal waste before it is transported from the site. Provide certified portable scales or utilize another method acceptable to the Project Manager to determine the weight of the waste.

f. When paint removal waste is transported off site for disposal, the Contractor shall compare weight tickets from the disposal facility with the weights obtained from the site scale and recorded on the site log. Discrepancies between the on site weights and the disposal facility weights shall be immediately be brought to the attention of the Project Manager.

5. Disposal Documentation

a. The Contractor shall submit written evidence that the hazardous waste treatment, storage, or disposal facility (TSD) is approved for lead disposal by the EPA and the state, and submit one copy of the completed manifest, signed and dated by the initial transporter in accordance with 40 CFR 262.

b. The Contractor shall provide to the Project Manager fully completed shipping manifests from the waste hauler and a certificate of disposal from the waste disposal facility for the transport and disposal of the paint removal waste.

c. The Contractor shall submit a completed PA Module 1 (Form ER-WM-14) if the waste disposal facility is located in Pennsylvania.

3.03 NOTED RESTRICTIONS

A. Waste material shall be removed from ground protection by vacuuming.

1. Sweeping, shoveling, or other mechanical means to remove the waste materials from ground protection shall not be permitted.

2. Air exhausted from vacuuming equipment shall pass through a HEPA filtering system. A HEPA filter is defined as a filter that is at least 99.97% efficient against particles that are 0.3 micron in diameter.

B. All waste resulting from paint removal operations shall be in transit from the temporary storage area to the disposal site no later than 30 calendar days subsequent to generation or two (2) weeks following demobilization of the site, whichever occurs first.

END OF SECTION 02075
SECTION 02085
TREATMENT AND HANDLING OF MATERIALS WITH ASBESTOS

PART 1 – GENERAL

1.01 DESCRIPTION

A. This work is the proper abatement and disposal of the Regulated Asbestos Containing Materials (RACM) from the location identified during RACM inspection of all existing carried utilities and ductbanks embedded in concrete.

B. This work also includes the associated preparation and implementation enforcement for a site-specific Health and Safety Plan (HASP).

C. Asbestos containing materials may be located in areas not accessed during sampling. All materials listed in the USEPA’s publication “Managing Asbestos in Place,” Appendix G, are suspect and shall require testing or special handling in accordance with this Section.

1.02 RELATED WORK

A. Section 01010 - Summary of Work

B. Section 01300 – Submittals

C. Section 02070 – Selective Demolition – Bridge

1.03 DEFINITIONS

A. Asbestos Containing Material (ACM): means any material that contains >1% asbestos by weight.

B. Category I nonfriable asbestos-containing material (ACM): means asbestos containing packings, gaskets, resilient floor tiles, and asphalt roofing products containing > 1% asbestos.

C. Category II nonfriable asbestos-containing material (ACM): means all other ACM that are not considered Category I non-friable, e.g. Transite®, cement board products, caulking, and expansion joint materials.

D. Friable Asbestos Material means any material that contains > 1% asbestos that when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. The term also includes nonfriable ACM after such previously nonfriable material becomes damaged to the extent that, when dry, it may be crumbled, pulverized or reduced to powder by hand pressure.

E. NESHAP Regulated Asbestos Projects: mean all demolition projects and asbestos renovation projects that meet the RACM definition.

F. Regulated Asbestos-Containing Materials (RACM), means:
   1. Friable asbestos material, material that contains > 1% asbestos, that is present in quantities > 80 linear feet on pipes, or 40 square feet on other facility components, or
35 cubic feet on other facility components where the area could not be measured previously; and/or
2. Category I nonfriable ACM that has become friable, or that will be or has been subject to sanding, grinding, cutting, or abrading; and/or
3. Category II nonfriable ACM that has a high probability of becoming friable during demolition or renovation operations.

1.04 REFERENCES

A. Codes, Regulations, Reference Standards and Specifications:

1. Codes and regulations of the jurisdictional authorities.
2. OSHA – Standards as applicable.
3. United States Environmental Protection Agency, Managing Asbestos in Place.
8. 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.

1.05 SUBMITTALS

A. In accordance with Section 01300, submit the following for approval:

1. Names of the qualified persons performing this work. All Contractor personnel performing this work are to be accredited in accordance with applicable federal, state, and local regulations, standards, codes and guidelines.
2. Superintendent's qualifications and certification numbers as required by laws and regulations cited under applicable federal, state, and local regulations, standards, codes, and guidelines.
3. Project schedule for removal and disposal of asbestos-containing material.
4. A detailed Asbestos Removal and Demolition Plan and a Contaminated Material Handling (disposal) Plan. The detailed method shall include development and implementation of a site specific HASP that includes appropriate provisions and specifications to ensure adequate protection of all on-site personnel and the general public.
5. The RACM inspection report and the completed Commonwealth of Pennsylvania’s "ASBESTOS ABATEMENT AND DEMOLITION/RENOVATION NOTIFICATION FORM".
6. Submit statements or drawings that indicate the means and methods that will be employed to remove the presumed suspect materials.
7. Landfill Records: The Contractor shall submit a letter from a permitted Hazardous Waste Facility, stating that the facility has agreed to accept the waste generated by the work; is authorized to accept the waste under laws of the State of residence; has the required capacity to treat and dispose of the materials; and will provide or ensure the ultimate disposal method indicated on Uniform Hazardous Waste Manifest.
8. Do not commence removal activities until the Project Manager has in writing acknowledged acceptance of all submittals.

1.06 QUALITY ASSURANCE

A. During the bid period, it is recommended to inspect and examine the construction site and existing construction to be removed and determine the type of demolition required or dismantlement procedure, physical conditions, and any contingency that could be encountered during the demolition procedures

B. Consider the safety of the work, safety of the people, and property on and adjacent to the work site when determining equipment movement and use of materials and equipment on the work site. All work shall be undertaken in accordance with applicable federal, state, and local regulations, standards, codes and guidelines.

1. Where the safety of persons is endangered within or adjacent to the area of demolition work, provide protection in accordance with requirements.

C. 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.

D. Storage or sale of removed items or materials on-site is not permitted.

E. Abatement Contractor shall have all licenses as required by state and federal laws.

PART 2 - EXECUTION

2.01 ASBESTOS INSPECTION

A. Contractor is required to have the existing utilities and ductbanks embedded in the concrete inspected by a City of Philadelphia certified asbestos investigator.

B. The inspector shall prepare a RACM Inspection Report.

2.02 HEALTH AND SAFETY PLAN (HASP)

A. Prepare and submit a site-specific HASP to the Project Manager prior to any on-site activities. Establish and maintain a complete HASP for the asbestos removal operations for all operations and all personnel working at the site during waste management activities. Commence on-site activities only after submitting the HASP to SEPTA. The HASP must
comply with the requirements of Occupational Safety and Health Administration Regulation 29 CFR Part 1910.120(b).

B. Have an approved plan of disposal in place prior to demolition activities. As part of the HASP, submit, as a minimum, the following:
   1. The method and time frame anticipated for sampling of the material for disposal;
   2. The testing lab that will perform the analysis on the samples and the anticipated time frame to obtain the results of the analysis;
   3. Identify the disposal facility to which the unsuitable materials will be delivered, and obtain and provide copies to the Project Manager of all relevant permits or approvals required for disposal prior to removal of unsuitable materials.

C. Provide competent, adequately trained, experienced personnel; materials; equipment; and specified instrumentation to provide monitoring of all waste management activities ongoing at any one time within the project. Provide personal protective equipment to all site personnel, including SETPA’s personnel and representatives. Revise HASP as necessary to address changing site conditions. All revisions to the HASP must be received by SEPTA. Establish and maintain a complete HASP for all operations and all personnel working at the site during construction and waste management activities.

2.03 GENERAL DEMOLITION

A. Demolish RACM containing material completely in accordance with Section 02070 and as follows:
   1. Comply with all federal, state, county, and local regulations and guidelines regarding inspection, sampling, testing, notification, certification, removal, handling and disposal of RACM. Complete and submit the ASBESTOS ABATEMENT AND DEMOLITION/RENOVATION NOTIFICATION FORM and reports to the appropriate agencies at least ten (10) working days prior to the start of any abatement activities. Provide copies of this notification and permit application to the Project Manager prior to the start of work.
   2. All RACM waste must be removed by a qualified asbestos abatement contractor, utilizing workers certified by PA Department of Labor and Industry. All friable ACM must be properly containerized in labeled double layer disposal bags. All containerized ACM must be transported in a sealed vehicle and consigned to a landfill approved for accepting asbestos waste by the Pennsylvania Department of Environmental Protection. Documentation of the waste disposal (i.e., manifests, bills of lading, weight tickets, certificates of disposal, etc…) should be obtained by the contractor and given to the Representative.

B. In the event that the Contractor identifies unexpected RACM, the Contractor must notify the Project Manager immediately.

C. Removal of non-friable asbestos containing materials shall be performed in such a manner that the materials remain non-friable during demolition. It is the Contractor’s responsibility to ensure that the materials are removed without rendering the material friable.

D. Control and prevent the spread of dust to occupied portions of the site and avoid creation of a nuisance in the surrounding area.
   1. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
E. Remove trash and debris daily unless otherwise directed by the Project Manager and do not allow construction debris and waste materials to accumulate.

2.04 WORK AREA CLEANUP AND CLEARANCE

A. Clean-up procedures shall utilize HEPA-filtered vacuum systems and/or wet methods, such as mopping, wet wiping, shoveling of wet debris, etc. No dry sweeping of dust, particulate matter or debris is allowed during any phase of the work affecting lead-coated surfaces.

B. Conduct periodic inspections.

C. At the end of the demolition Project, have a certified person conduct a clearance examination and provide appropriate documentation or statements of HASP compliance.

2.05 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition activities. Return adjacent areas to the condition existing prior to commencement of demolition activities.

END OF SECTION 02085
SECTION 02120
CLEARING AND GRUBBING

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. The Work of this Section includes, but is not necessarily limited to, the following:
   1. Removing existing vegetation.
   2. Clearing and grubbing.
   3. Stripping and stockpiling topsoil.
   4. Removing above- and below-grade site improvements.
   5. Disconnecting, capping or sealing, and abandoning site utilities in place.
   6. Temporary erosion- and sedimentation-control measures

1.02 RELATED SECTIONS

A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02070 – Selective Demolition – Bridge
D. Section 02072 – Selective Demolition – Roadway
E. Section 02200 – Earthwork
F. Section 02270 – Soil Erosion and Sedimentation Control
G. Section 02900 – Seeding and Mulching

1.03 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.
D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.
E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.
G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.
1.04 MATERIAL OWNERSHIP
   A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner’s property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.05 SUBMITTALS
   A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
      1. Use sufficiently detailed photographs or videotape.
      2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
   B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions

1.06 QUALITY ASSURANCE
   A. Preconstruction Conference: Conduct conference at Project site.

1.07 PROJECT CONDITIONS
   A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
      1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
      2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
   B. Utility Locator Service: Notify PA One Call for area where Project is located before site clearing.
   C. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place and the preconstruction meeting with authorities having jurisdiction is complete.
   D. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2– PRODUCTS
This Part not used.

PART 3– EXECUTION

3.01 PREPARATION
   A. Protect and maintain benchmarks and survey control points from disturbance during construction.
   B. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Wrap a 1-inch blue vinyl tie tape flag around each tree trunk at 54 inches above the ground.
   C. Protect existing site improvements to remain from damage during construction.
1. Restore damaged improvements to their original condition, as acceptable to Owner

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL
A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent roadways, properties, inlets, and walkways, according to approved erosion and sedimentation control drawings and requirements of authorities having jurisdiction.
B. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established. Measures should be inspected weekly and after each storm event.
C. Remove erosion and sedimentation controls after entire site is stabilized and restore and stabilize areas disturbed during removal.

3.03 EXISTING UTILITIES
A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Arrange with utility companies to shut off indicated utilities.
B. Excavate for and remove underground utilities indicated to be removed. Hand dig as necessary.
C. Removal of underground utilities is included in earthwork sections and with applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security and utilities sections.

3.04 CLEARING AND GRUBBING
A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.05 TREE AND SHRUB REMOVAL
A. Living trees and shrubs to be removed will be designated either by separate marking, marking in sample areas, or as otherwise identified. Where sample marking is adopted, do not disturb these sample areas until other areas are complete.
B. For designated live or dead trees and shrubs, and stumps, cut to the ground line or to a height of not more than 4 inches, as directed. Fell trees and remove in a manner preventing injury to remaining vegetation. In areas where felling is not permitted, due to possible damage for any reason, remove trees in sections.
C. Three existing trees along the southeastern sidewalk shall be removed, in order moving south away from the bridge toward 48th Street, they are:
   1. Littleleaf Linden (2.5" caliper B&B) at Station 1+55, Right 37’
   2. Red Maple (2.5" caliper B&B) at Station 1+35, Right 37’
   3. Littleleaf Linden (2.5" caliper B&B) at Station 1+08, Right 37’

Addendum 3 - January 4, 2017
3.06 TOPSOIL STRIPPING
A. Remove sod and grass before stripping topsoil.
B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
   3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.07 SITE IMPROVEMENT
A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of anti-rust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.08 DISPOSAL OF SURPLUS AND WASTE MATERIALS
A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
B. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.
C. Until the project is completed, properly maintain selective tree removal and trimming, including retreatment of sucker growth, the removal of wind-thrown trees and plants or parts of plants, which die from any cause.

END OF SECTION 02120
SECTION 02160
EXCAVATION SUPPORT AND PROTECTION

PART 1– GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of all labor, materials, equipment and services necessary to design, furnish, fabricate, install excavation support and protection systems and, unless indicated otherwise, remove excavation support and protection systems where shown on the Contract Drawings, as specified herein, and as needed to adequately protect structures and utilities from damage or displacement. The work includes all incidental and miscellaneous items not specified under another Section but required for the work of this Section, whether or not specifically referred to herein.

B. The work includes installation and maintenance of temporary excavation support systems required throughout the duration of work. The work also includes the removal of temporary excavation support systems and restoration of structures and utilities to a condition equivalent to that prior to the start of the work.

C. Excavation support systems that retain earth on which the support or stability of existing structures, railroad tracks or utilities is dependent or where required for safety or by governing laws, shall be cut 1-foot below grade minimum and left in place at the completion of work, at the direction of the Project Manager.

D. The Contractor shall be required to maintain the excavation support and protection system in place, and remove it from the job site only after its function has been accomplished or when directed by the Project Manager. Excavation support and protection systems may be cut 1-foot below grade minimum and left in place adjacent to the existing media-elwyn regional rail tracks to avoid track disturbance/damage. Temporary excavation support adjacent to existing buildings or retaining wall structures may be left in place to avoid disturbance/damage, or the Contractor may submit detailed staging/procedure for removal that avoids disturbance/damage to existing structures, for review and approval by SEPTA/PSD.

E. The Contractor shall provide detailed construction work plans and staging plans for the installation of temporary excavation supports, excavation, coordination with existing underground utility facilities, and underpinning of the existing building foundation, and underpinning of existing retaining wall foundations.

F. This Section includes, but is not limited to, the following items:
   1. Unbraced sheet pile walls.
   2. Braced sheet pile walls.
   3. Soldier pile and lagging walls.
   4. Timber sheeting and bracing.
   5. Shoring and underpinning.

1.02 RELATED SECTIONS

A. Contract Agreement
B. Division 1 – General Requirements
C. Section 01050 – Field Engineering: for monitoring of structure and track during sheeting and shoring.
D. Section 01060 – Regulatory Requirements and Safety
E. Section 01065 – Railroad Safety Requirements
F. Section 01300 – Submittals
G. Section 02170 – Vibration Monitoring and Condition Survey
H. Section 02200 – Earthwork
I. Section 02220 – Excavation, Backfill and Compaction

1.03 SUBMITTALS
A. Submit the following in accordance with Section 01300:
   1. Shop Drawings for excavation support systems showing all proposed materials, erection details and methods of installation, including length of member, elevations of sheeting, elevations of soldier piles, cut-off elevations, and locations of handling holes, and proposed methods of cutting through supports where supports will be penetrated by utilities.
   2. Structural design calculations prepared for each proposed excavation support system submitted for review only. Calculations shall be signed and sealed by a licensed Professional Engineer registered in the Commonwealth of Pennsylvania.
   3. Product Data: Manufacturer's descriptive product data, current specifications and installation instructions for materials or systems proposed for the work of this Section.
   4. Certified mill test reports for steel sheet piles, soldier piles and bracing.
   5. A complete description of the hammer and driving equipment including caps and guides for steel sheet piling and soldier piles.
   6. Verification of welder qualifications.
   7. The proposed procedure for installing sheet piling and soldier piles including the sequence for driving all piles.
   8. Results of Contractor subsurface investigations including test boring logs and utility locations.
   9. Detailed construction work plans and staging plans for the installation of temporary excavation supports, excavation, coordination with existing underground utility facilities, and underpinning of the existing building foundation, and underpinning of existing retaining wall foundations.

1.04 QUALITY ASSURANCE
A. Reference Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   2. American Railway Engineering and Maintenance-of-Way Association (AREMA):
      a. ASTM A36/A36M, Carbon Structural Steel.
      b. ASTM A153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      c. ASTM A307, Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
      d. ASTM A328/A328M, Steel Sheet Piling.
      e. ASTM A572/A572M, High-Strength, Low-Alloy Columbium-Vanadium Structural Steel.
      f. ASTM A992/A992M, Steel for Structural Shapes for Use in Building Framing.
   4. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Specifications, Publication 408.
   6. Western Wood Products Association (WWPA):

B. Provide for the protection of the public, employees and property, in accordance with applicable requirements of 29 CFR Part 1926, Subpart P, "Excavation, Trenching and Shoring", Construction Safety and Health Regulations (OSHA), which, by reference is made a part of this specification, including sections relative to protection of the public; sheeting, shoring and bracing; and trenches and excavating.

C. The Contractor shall have either in his/her employment or on a consulting basis, a structural engineer who is registered as a Professional Engineer in the Commonwealth of Pennsylvania, and who is qualified to determine extent of work necessary to satisfy requirements of this Section.

1.05 DEFINITIONS

A. Protection of Structures is defined as the provision of all necessary construction to securely support the structure being protected. Protection shall include restoration of the structure upon completion of such work.

B. Excavation Support is the support system installed prior to, during and immediately following excavation, to minimize ground movement and slippage, and to maintain the stability of the excavation while constructing the structure.

C. Restoration is defined as the correction, by repair or replacement, of portions of a structure damaged or altered as a result of the Contractor's operations. Restore to the equivalent condition existing prior to the start of work and to the satisfaction of the Project Manager.

D. Structures are defined as buildings, railroad tracks, above surface and underground structures, including pavements and underground pipelines and utilities that may be affected by the Contractor's operations.

E. Displacements are defined as vertical and/or horizontal movements measured at either the exposed surface of a structure or within the soil overburden within five feet of the structure. Movements may occur as a result of the Contractor's operations prior to, during, or after installation of the excavation support system.

1.06 DESIGN REQUIREMENTS

A. The design of temporary excavation support systems, not detailed on the Contract Drawings but necessary to protect personnel, structures or utilities, is the sole responsibility of the Contractor. Engage a Licensed Professional Engineer, currently registered in the Commonwealth of Pennsylvania, to prepare, sign and seal the design calculations and to supervise, sign and seal the design drawings for excavation support systems proposed for this project.

1. Base design of excavation support systems on existing loads and construction conditions. Existing loads to be considered include, but are not limited to, those caused by soil pressure, hydrostatic pressure, existing structures, stored material, and moving and stationary vehicles, railroad trains and equipment. Design excavation supports in a manner that will permit construction to proceed, enable supports to present no threat to public safety, and protect completed work and other property from damage that would result from ground movement.

2. Design calculations shall include design assumptions, lateral earth pressures, and surcharge loads. Calculations shall include design stresses and total loads and displacements in the structural shoring members during each phase of the excavation and bracing installation where applicable. Calculations shall provide an overall stability analysis to justify embedment depths and extent of lateral bracing. If vertical sheeting or lateral bracing is deemed not necessary, provide stability analysis computations to justify these conclusions.
3. Obtain any additional information necessary for the design including, but not limited, to soil test borings and foundation plans.

B. Conform to applicable local, State and Federal regulations for the erection of excavation support systems.

C. Sequence of construction, including any required excavation, filling or backfilling, shall conform to the requirements shown on the Contract Drawings and as specified in Section 02200.

D. Sheet piles or soldier piles shall not be installed until the Project Manager has approved the method of installation and the sequence of driving.

E. Excavation support systems may be cut 1-foot below grade minimum and left in place only where indicated on the Contract Drawings or with the written permission of the Project Manager. Excavation support systems that retain earth on which the support or stability of existing structures, railroad tracks or utilities is dependent or where required for safety or by governing laws, shall be cut 1-foot below grade minimum and left in place at the completion of work. Protect existing structures, including railroad tracks and overhead and buried utility lines, to the satisfaction of the Project Manager.

F. Alignment and Tolerances
   1. Unless otherwise shown on the Contract Drawings, after installation, the slope of steel sheet piling and soldier piles shall not deviate from vertical by more than one percent.
   2. Sheet and soldier piles at cut-off elevation shall not deviate laterally from required location as required to ensure complete protection for the excavation.

G. The top of the sheeting elevation should be 6 inches below the top of the rail elevation to allow for safe SEPTA train car passages at night.

H. Design temporary excavation support and protection system based on the following parameters:
   1. SOIL PARAMETERS
      a. Effective Angle of Friction: 30 degrees
      b. Moist Unit Weight of Soil: 120 pounds per cubic foot
      c. Saturated Unit Weight of Soil: 125 pounds per cubic foot
      d. Effective Cohesion: 0 pounds per cubic foot
      e. Static Groundwater Level at Elevation: 60 feet
      f. Undrained Shear Strength of Cohesive Soil: Not Applicable
      g. Shear Strength for Rock Mass: 25 kips per square foot

1.07 DELIVERY, STORAGE AND HANDLING

A. Exercise care to avoid bending, scraping and overstressing the sheet piling and soldier piles. Block with wood or otherwise protect the sheeting and soldier piles from being bent or injured.

B. Load, transport, unload and store sheet piling and soldier piles in such a manner that the metal is kept clean and free from injury. Store materials above ground on platforms, skids or other supports and cover and protect it from corrosion.

1.08 PROJECT CONDITIONS

A. The Contractor, by careful examination, shall inform itself as to the nature and location of the work: the conformation of the ground; the nature of the subsurface conditions; the location of the groundwater table; the character, quality and quantity of the materials to be encountered; the character of the equipment and facilities needed preliminary to and during the execution of the work; and all other matters which can in any way affect the work.
B. The Contractor shall be held to have visited the site and to have become familiarized with existing conditions of adjoining properties, utilities and buildings.

C. Subsurface soil borings and soil samples are available for the Contractor’s review and interpretation. SEPTA makes no interpretations, predictions or representations regarding the character or extent of soil, rock, or other subsurface conditions to be encountered during the work.

D. Assume all risks for the protection of overhead or underground public utility and private lines, pipes, conduits and support work, existing structures, sidewalks, and property of whatever nature.

E. Damage to such structures or to any persons or property associated with such structures, where such structures are or are not shown on the Contract Drawings, is the responsibility of the Contractor.

F. The Contractor shall be responsible to pay for restoration of such damaged structures back to equivalent original condition at no expense to SEPTA.

PART 2– PRODUCTS

2.01 MATERIALS

A. Steel Sheet Piling: Provide steel sheet piling that conforms to the requirements of ASTM A328/A328M.

B. Sheet Piling Corners, Tees, Wyes and Crosses: Provide sheet piling corners, tees, wyes and crosses that conform to the requirements of ASTM A328/A328M.

C. Steel Bracing: Provide steel bracing that conforms to the requirements of A36/A36M, ASTM A992/A992M or ASTM A572/A572M Grade 50.

D. Soldier Piles: Provide soldier piles that conform to the requirements of A36/A36M, ASTM A992/A992M or ASTM A572/A572M Grade 50.

E. Bolts, Nuts and Washers: ASTM A307/A307M, galvanized to 2 oz. per square foot, in accordance with ASTM A153, unless otherwise shown on the Contract Drawings.

F. Timber: Provide No. 2 (No. 1 Mining) Coastal Douglas Fir, Long-leaf Southern Yellow Pine or approved equal, conforming to WWPA Catalog A or SPIB Grading Rules.

G. Timber Lagging: Untreated structural lumber consisting of mixed hardwoods, of nominal thickness indicated or as required.

H. Steel sheeting, soldier piles, waling and bracing may consist of new or used material but shall be in satisfactory condition and approved by the Project Manager. These materials shall be suitable for the intended use. The Project Manager may disapprove and reject used materials regarded to be unsatisfactory at no additional cost to SEPTA.

I. Other Materials: Those best suited for use intended, approved by the Engineer and indicated on accepted working drawings and in accordance with applicable sections of PennDOT Publication 408.

2.02 EQUIPMENT

A. Pile Driving Equipment
   1. Use an approved driving head designed to properly fit a pair of sheet piles to prevent damage to the top of the piles during driving.
2. Use an approved impact or vibratory pile hammer of sufficient size to drive the sheet piles to the required depth without causing stresses in excess of 90 percent of the yield strength (Fy) of the pile material due to driving.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Before starting work, check and verify governing dimensions and elevations.

B. Three to ten days prior to starting work, contact the Pennsylvania One Call System (800-242-1776) to mark locations of existing utilities. Locate all adjacent utilities by test holes prior to excavation or installation of sheet piling or soldier piles. Verify locations of all adjacent utilities. Relocate sheet piling or soldier piles or interfering utilities as required.

C. Contact the Project Manager to arrange required outages, flagpersons and other provisions.

D. Hand dig exploratory trenches where railroad or utility underground installations are known or suspected prior to placing and driving temporary sheeting in accordance with the provisions of Section 02200.

E. Install all necessary excavation support systems prior to commencing excavation. Provide, erect and maintain sheeting and bracing around all sides of excavation as applicable. Perform excavation in accordance with the requirements specified in Section 02200.

F. Maintain safe clearance between overhead utilities and crane equipment or drill rig booms during installation of sheet piling or soldier piles.

G. Shoring systems that retain earth on which the support or stability of existing structures, railroad tracks or utilities is dependent shall be cut 1-foot below grade minimum and left in place at completion of the work. Where required for safety or by governing regulations, and when so directed in writing by the Project Manager, leave sheeting in place. In such instances, remove original braces and rebrace sheeting against the structure in a manner approved by the Project Manager. Cut off sheeting at elevations 1-foot below grade minimum and as directed by the Project Manager.

H. Locate sheeting and bracing to clear permanent construction and to permit forming and finishing of concrete surfaces. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to the Project Manager.

I. Install internal bracing, if required, to prevent spreading or distortion to braced frames.

J. Remove excavation support in stages to avoid disturbance to underlying soils and damage to structures, railroad tracks, pavement, facilities and utilities.

K. Should any subsidence or other damage occur to the inefficiency or inadequacy of the work, the Contractor shall be responsible for restoration of the conditions at its own expense.

L. Repair or replace, as directed by the Project Manager, adjacent work damaged or displaced through the installation or removal of shoring and bracing work.

M. Welding and Splicing
   1. Perform all welding in accordance with requirements for shielded metal arc welding in accordance with ANSI/AWS D1.1/D1.1M for buildings and other structures.
   2. Only use welders qualified by tests prescribed in ANSI/AWS D1.1/D1.1M, as applicable.
   3. Reinforce pile tips, if required due to field conditions and as approved by the Project Manager.
4. Except where directed by the Project Manager, splicing of sheet piles or soldier piles will not be permitted.

N. Sheet Pile Driving
1. Use an approved guide frame or template to set sheet piles in proper position and alignment and to provide adequate lateral support to maintain vertical alignment during driving. Where field conditions require, use two levels of guide wales to maintain vertical alignment during driving.
2. Steel sheet piles shall be properly set and "shaken out" prior to driving. After placing a pair of sheets within their interlocks, they shall be lowered as far as possible. Should the sheets bind or hang up in their interlocks before bearing on the ground, adjacent sheets shall be picked up in pairs and shaken out as required, until the sheets ride smoothly within their interlocks and simultaneously bear on the ground.
3. Top of sheet pile shall be normal to the driving force.
4. Drive sheet piles to the elevation(s) required to adequately support the retained earth as derived by the Contractor's Professional Engineer. Each pair of sheet piles shall not be driven more than five feet ahead of the adjacent sections.
5. Sheet piles shall be driven in such a manner as to prevent piles from leaning in the direction of driving and to provide a continuous closure of sheet piles, where closure is required. Where possible, drive sheet piling with the ball end leading. If an open socket is leading, provide a bolt or similar object in the bottom of the interlock to keep the interlock free of soil material.
6. At the completion of the driving operation on a sheet pile, the installed sheet pile shall be undamaged, free of defects and in compliance with the requirements of this Section.
7. No jetting will be permitted without the specific approval of the Project Manager.

3.02 FIELD QUALITY CONTROL
A. Maintain at all times the safety, stability and integrity of any structures and utilities of whatever nature regardless of location that might be affected.
B. Construct excavation support systems in accordance with approved Shop Drawings.
C. Assume full responsibility for the design, construction, performance and stability of all excavation support systems and related operations.
D. Construct excavation support systems in accordance with approved Shop Drawings.
E. Assume full responsibility for the stability of all excavation support systems and related operations.

END OF SECTION 02160
SECTION 02170
VIBRATION MONITORING AND CONDITION SURVEY

PART 1– GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of the services required to establish pre-construction condition of the existing buildings located at 4751 Woodland Avenue (Southwest corner), and 4720 Woodland Avenue (Northeast corner), monitor vibration producing activities (such as pile driving, bridge demolition, vibratory compaction, pavement breaking or operation of heavy construction equipment) during construction, and establish post-construction condition of structures.

1.02 RELATED SECTIONS

A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02070 – Selective Demolition - Bridge
D. Section 02072 – Selective Demolition - Roadway
E. Section 02160 – Excavation Support and Protection
F. Section 02200 – Earthwork
G. Section 02220 – Excavation, Backfill and Compaction
H. Section 02225 – Class 1, Class 1 A, and Class 1B Excavation
I. Section 13090 – Underpinning of Existing Retaining Walls and Building

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01300:
   1. Vibration specialists’ names and qualifications.
   2. The proposed procedure to establish a safe vibration level and monitor the vibrations during vibration producing activities (such as pile driving, vibratory compaction, pavement breaking or operation of heavy construction equipment).
   3. At least 30 days prior to start of such work, the Contractor shall provide a plan to the Project Manager, which shall include, but not be limited to the following:
      a. Proposed construction method(s)
      b. Vibration monitoring plans (including the format for reporting the vibration readings)
      c. Anticipated vibration levels at the closest building(s)
      d. Condition survey format
      e. Public relations activities
   4. Pre-construction and post-construction condition survey conducted by Professional Engineer in the Commonwealth of Pennsylvania.
   5. A copy of all reports shall be provided to the Project Manager.

1.04 QUALITY ASSURANCE

A. The Contractor shall have either in his/her employment or on a consulting basis, a structural engineer who is registered as a Professional Engineer in the Commonwealth of Pennsylvania.
Pennsylvania, and who is qualified to determine extent of work necessary to satisfy requirements of this Section.

1.05 DEFINITIONS
A. Restoration is defined as the correction, by repair or replacement, of portions of a structure damaged or altered as a result of the Contractor's operations. Restore to the equivalent condition existing prior to the start of work and to the satisfaction of the Project Manager.
B. Structures are defined as buildings, retaining walls, railroad tracks, above surface and underground structures, including pavements and underground pipelines and utilities that may be affected by the Contractor's operations.

1.06 PROJECT CONDITIONS
A. The Contractor is advised that structures are located close to the proposed work and that construction activities shall be conducted so as to preclude damage to same.
B. The Contractor shall be responsible for installing shoring and underpinning for the structures adjacent to the bridge, following Section 13090 and as follows:
   1. Structure at northeast will require shoring.
   2. Structure at southwest will require underpinning of the existing building.
   3. Structure at southeast will require underpinning of an existing retaining wall.
C. The Contractor shall be responsible for any damage caused by construction activities.
D. Damage to such structures or to any persons or property associated with such structures, where such structures are or are not shown on the Contract Drawings, is the responsibility of the Contractor.
E. The Contractor shall be responsible to pay for restoration of such damaged structures back to equivalent original condition at no expense to SEPTA.

PART 2– PRODUCTS

2.01 EQUIPMENT
A. Vibration monitoring equipment capable of continuously recording the peak particle velocity and providing a permanent record of the entire vibration event.

PART 3– EXECUTION

3.01 PRECONSTRUCTION CONDITION SURVEY
A. A preconstruction building Condition Survey shall be conducted by the Contractor on the buildings abutting Woodland Ave Bridge at 4751 Woodland Avenue (Southwest corner), and 4720 Woodland Avenue (Northeast corner), prior to the commencement of any vibration producing activity.
B. The survey will include documentation of interior sub-grade and above grade accessible walls, ceilings, floors, roof and visible exterior as viewed from the grade level. It will detail (by engineering sketches, video tape, photographs, and/or notes) any existing structural, cosmetic, plumbing or electrical damage. The survey will be conducted by a Professional Engineer, registered in the State of Pennsylvania.
C. A report shall be issued that will summarize the preconstruction condition of the building(s) and will identify areas of concern, including potential personnel hazards (falling debris) and structural elements that may require support or repair.

D. Crack displacement monitoring gages will be installed as appropriate across any significant existing cracks to help verify any additional building distress if it should develop. The appropriate location, number, and type of gages will be established by the Contractor’s Professional Engineer licensed in Pennsylvania. The gages will be read prior to vibration producing activities, as well as during these activities. Data shall be obtained on a weekly basis for as long as vibration-producing activities are being conducted. A report shall be submitted which summarizes the data. The Project Manager shall be alerted if any significant movement is detected by the monitoring gages.

3.02 **VIBRATION CONTROLS**

A. The Contractor shall employ a qualified vibration specialist to establish a safe vibration level for the buildings abutting Woodland Ave Bridge. This specialist shall also supervise the Contractor’s vibration-monitoring program.

B. During all vibration producing activities, the Contractor shall monitor vibration levels at the buildings abutting Woodland Ave Bridge, and shall not exceed the safe level established to preclude damage to these structures.

C. The vibration monitoring equipment shall be capable of continuously recording the peak particle velocity and providing a permanent record of the entire vibration event.

D. Copies of all vibration records and associated construction activity (pile driving, pavement breaking, etc.) data shall be provided to the Project Manager in a format approved by the Project Manager.

3.03 **PUBLIC RELATIONS**

A. The Contractor shall maintain a complaint log and make this available to the Project Manager on request.

B. Occupants/owners of adjacent buildings shall be notified by the Contractor at least 2 weeks prior to commencement of any vibration producing activity that might affect the structure or inhabitants.

3.04 **POST-CONSTRUCTION CONDITION SURVEY**

A. A post-construction building Condition Survey shall be conducted by the Contractor on the buildings at abutting Woodland Ave Bridge, prior to the commencement of any vibration producing activity.

B. The survey will include documentation of interior sub-grade and above grade accessible walls, ceilings, floors, roof and visible exterior as viewed from the grade level. It will detail (by engineering sketches, video tape, photographs, and/or notes) any structural, cosmetic, plumbing or electrical damage. The survey will be conducted by a Professional Engineer, registered in the State of Pennsylvania.

C. A report shall be issued that will summarize the post-construction condition of the building(s) and will identify structural elements that require restoration.

D. If damage occurs to existing structures Contractor is responsible to document damage, evaluate and prepare design for necessary repairs, and construct structure repairs at no expense to SEPTA.
END OF SECTION 02170
SECTION 02200
EARTHWORK

PART 1 – GENERAL

1.01 DESCRIPTION
A. The work specified in this Section consists of all labor, materials, equipment and services necessary to excavate soil and rock material and backfill with specified materials for various purposes described herein and in compliance with the sections, details and grades as shown on the Contract Drawings.
B. This Section includes excavating and backfilling for structures and construction access.
C. Earthwork also includes, but is not necessarily limited to, the following:
   1. Delivery of materials to the project site, storage, distribution, placement, compaction, testing and satisfactory disposal of all excavated materials.
   2. Construction of grade to the lines and grades indicated on the Contract Drawings.
   3. Inspection of subgrade materials at the work site and in place and as herein specified in accordance with Section 01400 – Quality Requirements.
D. This work is overexcavation of wet/weak soil or very broken rock beneath the bottom of footing or bottom of wingwall footings to achieve satisfactory bearing capacity as directed, including backfilling with PennDOT 2A Coarse Aggregate to proposed footing elevation.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 - General Requirements
C. Section 01500 - Construction Facilities and Temporary Controls
D. Section 01510 - Maintenance, Support and Restoration of Existing Utility Facilities
E. Section 02160 – Excavation Support and Protection
F. Section 02170 – Soil Erosion and Sedimentation Control
G. Section 02280 - Geotextiles
H. Section 02220 – Excavation, Backfill and Compaction

1.03 DEFINITIONS
A. Backfill: Soil material used to fill an excavation.
B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
C. Bedding Course: Course placed over the excavated subgrade before placing foundation.
D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by SEPTA. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by SEPTA. Unauthorized excavation, as well as remedial work directed by SEPTA, shall be without additional compensation.

F. Fill: Soil materials used to raise existing grades.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subbase Course: Course placed between the subgrade and base course for hotmix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

I. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

J. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Product Data: For the following:
   a. Geotextile
   b. Each type of plastic warning tape

2. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   a. Classification according to ASTM D2487 of each on-site and borrow soil material proposed for fill and backfill.
   b. Laboratory compaction curve according to ASTM D698 for each on-site and borrow soil material proposed for fill and backfill.

3. Preexcavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.05 QUALITY ASSURANCE

A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.

   a. ASTM C33, Concrete Aggregates.
   b. ASTM D698, Laboratory Compaction Characteristics of Soil Using Standard Effort.
   c. ASTM D1556, Density and Unit Weight of Soil in Place by the Sand-Cone Method.
d. ASTM D2167, Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

e. ASTM D2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

f. ASTM D2937, Density of Soil in Place by the Drive-Cylinder Method.

g. ASTM D2940, Graded Aggregate Material for Bases or Subbases for Highways or Airports.

h. ASTM D6938, In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

2. Commonwealth of Pennsylvania Department of Transportation (PennDOT):

   a. PennDOT Publication 408, Specifications
   b. PennDOT Publication 72M, RC-12M

   B. Use adequate number of skilled personnel 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.

   C. Pre-Excavation Conference: Conduct conference at Project site to be coordinated by SEPTA Project Manager.

1.06 PROJECT CONDITIONS

A. Coordination: Coordinate work of this Section with the work of other trades so that construction is not delayed.

B. Existing Service Utilities:

1. Preserve, protect and maintain at all times existing service utilities during all earthwork operations.

2. Locate existing underground utilities in the areas of work before starting earthwork operations for utilities that are to remain in place. Determine depth of existing utilities by hand-dug test pits. Provide adequate means of protection during earthwork operations in accordance with the excavation support and protection measures described in Section 02160.

3. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Project Manager immediately for directions as to procedure. Cooperate with public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the utility owner.

4. Do not interrupt existing utilities serving facilities occupied and used by SEPTA or others except when permitted in writing by the Project Manager and then only after arranging to provide temporary utility services according to requirements indicated.

5. Notify Project Manager not less than two days in advance of proposed utility interruptions.

6. Do not proceed with utility interruptions without Project Manager’s

C. Site Information:

1. Site information regarding subsurface conditions within the project limits is extremely limited. See Structure Foundation Investigation Report prepared by American Geotechnical & Environmental Services, Inc. Rock excavation may be required depending on the selected foundation types and for access and construction of crane pads, haul roads, and foundation excavations. Such limited data indicated on the
Contract Drawings are made available for the convenience of the Contractor and are not intended as representations or warranties of the continuity of such conditions. Core boxes will be made available for review of the limited subsurface data. It is expressly understood that SEPTA will not be responsible for interpretations or conclusions determined by the Contractor.

2. The Contractor may make additional exploratory operations at no additional cost to SEPTA. The Contractor, by a suitable method, may dig exploratory pits to determine the subsurface materials and conditions that may be encountered in the performance of the work under this Section.

D. Temporary Protection:
   1. Barricade open excavations made as a part of earthwork operations and post with warning tape and other suitable measures.
   2. Protect structures, utilities, sidewalks, pavements, fencing, and other facilities to remain from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, and ML or AASHTO M145 Soil Classification Groups A-1, A-2-4, A-2-5, A-3, and A-4 or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: ASTM D2487 Soil Classification Groups GC, SC, CL, OL, CH, MH, OH, and PT or AASHTO M145 A-2-6, A-2-7, A-5, A-6, and A-7, or a combination of these groups or as approved by the Project Manager.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve. PennDOT 2A Coarse Aggregate. PennDOT Publication 408M, Section 703. Type A Geotextile. PennDOT Publication 408M, Section 735.

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H. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

I. Sand: ASTM C33; fine aggregate, natural or manufactured sand.

J. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 GEOTEXTILES

A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M288 and the following, measured per test methods referenced:

1. Survivability: Class 1; AASHTO M288.
2. Apparent Opening Size: No. 70 sieve, maximum; ASTM D4751.
3. Permittivity: 0.1 per second, minimum; ASTM D4491.
4. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.03 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:

2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 – EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section 02120 Clearing and Grubbing.

C. Protect and maintain erosion and sedimentation controls, which are specified in Section 02270 during earthwork operations.

D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.
3.02 DEWATERING
   A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding project site and surrounding area.
   B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
      1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
      2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES
   A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL
   A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
      1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
      2. Blasting is not permitted.
      3. Excavation methods in soil and rock must minimize construction vibrations.
      4. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
         a. 24 inches outside of concrete forms other than at footings.
         b. 12 inches outside of concrete forms at footings.
         c. 6 inches outside of minimum required dimensions of concrete cast against grade.
         d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
         e. 6 inches beneath bottom of concrete slabs on grade.
         f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.
   B. Refer to the Contract Drawings and Section 02220 for information regarding the location and quantity of contaminated soils and hazardous materials present in the site, which are identified as unclassified excavation.

3.05 EXCAVATION FOR STRUCTURES
   A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections. Excavations for structures may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

2. Blasting is not permitted.

3. Excavation methods in soil and rock must minimize construction vibrations.

B. Overexcavation

1. Excavate to the bottom of footing elevation. Inspect the bearing material, overexcavate wet/weak soil or very broken rock at the bottom of footing as directed. Provide a level bottom of excavation, using steps and benches in soil or rock as shown or directed.

2. The Engineer will inspect and determine if bottom of excavation is suitable bearing material. If the Engineer determines bottom of excavation to be unsuitable, excavate to a depth that will provide suitable bearing material for the proposed structure but no deeper than two (2) feet prior to re-inspection by the Engineer.

3. Dispose of any unsuitable materials in accordance with Section 105.14.

C. Backfilling: Backfill with the following as directed:

1. Class 4, Type A Geotextile
   a. Place geotextile along the base and sides of the overexcavated area.

2. 2A Coarse Aggregate
   a. Place and compact 2A Coarse Aggregate in overexcavated area to the bottom of footing elevation.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 SUBGRADE INSPECTION

A. Notify SEPTA when excavations have reached required subgrade.

B. If SEPTA determines that unsatisfactory soil is present for spread footings bearing on soil (only applicable for the wingwalls), continue excavation and replace with compacted backfill or fill material as directed.

C. If SEPTA determines that unsatisfactory rock is present for spread footings bearing on rock, continue excavation and replace with lean concrete fill with 28-day compressive strength of 2,500 psi.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Project Manager, without additional compensation.

F. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.

2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

3.08 UNAUTHORIZED EXCAVATION
A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by SEPTA.

3.09 STORAGE OF SOIL MATERIALS
A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing at approved locations. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL
A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, damproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL FILL
A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
B. Place and compact fill material in layers to required elevations.
C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.12 SOIL MOISTURE CONTROL
A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.
3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D1557:
   1. Under structures, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
   3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.14 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Lawn or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.15 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
   1. Shape subbase and base course to required elevations and cross-slope grades.
   2. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
   3. Compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
3.16 FIELD QUALITY CONTROL

A. Testing Agency: The General Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades for spread footings bearing on soil (only applicable for the wingwalls), at least one test of each soil stratum will be performed to verify design bearing capacities. For spread footings bearing on rock at other locations, inspection will be performed by SEPTA to verify that the material at the base of the excavations is adequate for achieving the design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by SEPTA.

D. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D6938, and ASTM D2937, as applicable. Tests will be performed at the following locations and frequencies:
   1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area of building slab, but in no case fewer than 3 tests.
   2. Wall and Footing Foundations on Soil: At subgrade, at least 2 tests.
   3. Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
   4. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

F. Cost of testing under this Section to be included in the unit cost provided by the Contractor.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
   1. Scarify or remove and replace soil material to depth as directed by SEPTA; reshape and recompact.

C. Where settling occurs before project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off SEPTA's property.
PART 4 – MEASUREMENT AND PAYMENT

4.01 OVEREXCAVATION AND BACKFILLING UNDER FOUNDATIONS

A. Class 4, Type A Geotextile. Square Yard

B. 2A Coarse Aggregate. Cubic Yard

Includes excavation and backfill with the indicated material

No payment will be made for overexcavation and backfill in excess of the lateral limits shown on the Drawings.

Backfill of areas overexcavation to accommodate construction equipment or to satisfy PSHA requirements will be considered incidental to this work.

END OF SECTION 02200
SECTION 02220
EXCAVATION, BACKFILL AND COMPACTION

PART 1 – GENERAL

1.01 DESCRIPTION
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.

1.02 DEFINITIONS
A. Approved material: Material that meets specified requirements for use as embankment, fill or backfill.
B. Authorized excavation: Excavating to neat lines and limits shown and specified; excavating unsuitable material.
C. Backfill is the furnishing, placing and compacting specified materials to the lines and grades indicated, to fill an excavation, and also including:
   1. Testing density, liquid and plastic limits and gradation of compacted backfill.
D. 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:
   1. Dewatering.
   2. Legally disposing of waste materials and storing satisfactory excavated materials intended for reuse.
E. Excess excavation: Material excavated beyond or below cross section shown, as well as unavoidable over breakage in rock.
F. 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 Project Manager. Unauthorized excavation as well as remedial work directed by the Project Manager shall be without additional compensation.
G. Bedding material: Layer placed over the excavated subgrade in a trench before laying pipe.
H. Base course: Layer placed between the subgrade and paving.
I. 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.
J. Satisfactory Soil Materials: ASTM D 2487 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.

1.03 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 01060 – Regulatory Requirements/ Safety
D. Section 02070 – Selective Demolition - Bridge
E. Section 02072 – Selective Demolition - Roadway
F. Section 02160 – Excavation Support and Protection
G. Section 02160 – Vibration Monitoring and Condition Survey
H. Section 02230 – Subbase Course
I. Section 02270 – Soil Erosion and Sedimentation Control
J. Section 02290 - Geogrids
K. Section 02900 – Seeding and Mulching
L. Section 03100 – Concrete Forms and Accessories
M. Section 03300 – Cast-in-Place Concrete

1.04 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: 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:
      a. Obtain written permits and releases from owners of property where material will be deposited.
      b. Submit copies of each permit and release from each property owner absolving SEPTA from responsibility in connection with such disposal.

1.05 QUALITY ASSURANCE
A. Reference standards:
      a. C33, Concrete Aggregates
      b. D422, Test Method for Particle-size Analysis of Soils
      c. D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³)
      d. D1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
      e. D2167, Test Method for Density and Unit Weight of Soil in Place by the Rubber-Balloon Method
      f. D2216, Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock
      g. D2922, Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
      h. D4318 Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
      i. D2487 Standard Classifications of Soils for Engineering Purposes
   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 Subbase, Base and Surface Courses
      c. M80, Coarse Aggregate for Portland Cement Concrete
3. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
   a. PennDOT Publication 408, Specifications

1.06 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, culverts and sewers.
   2. Provide an approved method and schedule of construction to insure the safety of the existing structures. Any damage caused by the Contractor, is the responsibility of the Contractor. Repair such damage without any additional compensation.

   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 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 GENERAL

   A. Common Fill and Backfill:
   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: Four 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. AASHTO M43, Size No. 57

C. Sand cushion material in utility trenches shall be PennDOT Cement Concrete Sand, Type “A”.

D. Soil Backfill and Fill Material: Provide satisfactory soil materials for backfill and fill, free of debris, waste, frozen materials, vegetation, and other deleterious matter.
   1. Uses on-site excavated or off-site borrow material that has been sampled, tested, and certified as satisfactory soil material.
   2. Use approved satisfactory soil materials as backfill in all excavations required for the construction of new foundations, pits, and underground electrical and sewer lines.
   3. All backfill placed shall be compacted and tested as specified herein.
   4. Maximum particle size not exceeding four (4) inches, but not exceeding one (1) inch within one (1) foot of finished grade.

2.02 CRUSHED AGGREGATE FOR PAVEMENT
   A. No. 2A, Coarse Aggregate; PennDOT Publication 408, Specifications, 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. Satisfactory soil material as specified.

2.04 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
   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.
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 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 lean concrete, crushed aggregate or clean select soil approved by the 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 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 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. 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 un-obstructed. Take precautions to avoid pumping water through freshly placed concrete.

E. 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 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.
Excavation, Backfill and Compaction

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 Project Manager.

7. Excavation for the convenience of the Contractor shall conform to the limits specified by the 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. Unless otherwise specified, dewater all excavations before placing concrete. Remove water that has accumulated in the excavation after final inspection and before concrete placement using approved methods.

10. If unsuitable materials are encountered at the required subgrades, the Project Manager may authorize the removal of such unsuitable materials and replacement with fill material specified in Article 2.02 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

A. Place initial layer of fill and backfill only on subgrade which has been inspected and accepted by the Project Manager.

B. Place fill and backfill in six-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 percent of maximum standard dry density as determined in accordance with ASTM D698, Method D, or 90 percent of maximum standard dry density as determined in accordance with ASTM D1557 (Modified Proctor Test), 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 subbase 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.
D. Compact each layer of backfill material to not less than the specified percentage the maximum laboratory density determined by ASTM D1557. The backfill shall be compacted to 95 percent unless otherwise noted. In areas where compaction by machine is impractical, approved hand tampers shall be used to obtain the required density.

3.07 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 sub-grade.
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 D 698 or 95 percent of
maximum standard dry density as determined in accordance with ASTM D1557; or remove and replace material with compacted select backfill material and compact to 100 percent of maximum dry density, tested in accordance with ASTM D 698.

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. As per Specification 02200 Article 3.07F

3.08 FIELD QUALITY CONTROL
A. Test Method:
1. Determine the maximum dry density and the optimum moisture content in accordance with ASTM D698, Method D or ASTM D1557.

B. Testing:
1. Provide an independent testing agency qualified according to ASTM E 329
2. Test each source of material proposed to be used for fill and backfill and submit test results to the 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 D2922. 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 2500 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 D2922, and ASTM D 2937, as applicable.
5. Trench Backfill:
   a. Perform in-place compaction test every 100 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 D2922, and ASTM D2937, as applicable.

END OF SECTION 02220
PART 1– GENERAL

1.01 DESCRIPTION
A. This work is excavation for roadways, roadway appurtenances, and structures as shown on the Contract Drawings and as required to execute the work of this Contract. The three classes of excavation include Class 1 excavation, Class 1A excavation, and Class 1B excavation.

1.02 DEFINITIONS
A. Class 1 Excavation:
1. Excavation as shown on the Standard Drawings, for roadways, shoulders, ditches, drainage structures, stream channels, grade separation structures, retaining walls, and wingwalls.
2. Excavation, as indicated or directed, for benches and for the removal of existing pavements not being rehabilitated.
3. Excavation, as indicated or directed, for the removal of unsuitable material having a bottom width of 2.5 m (8 feet) or more.
4. Excavation, as indicated or directed, to allow for the placement of topsoil.
5. Excavation and stockpiling, as indicated or directed, for the removal of topsoil other than the first 200 mm (8 inches), which are incidental to the clearing and grubbing operations specified in Section 02120.
7. Removal of stone fences, piles of dirt or stones, individual boulders, and any portions of structures above the natural ground, when in excess of 0.5 m³ (1/2 cubic yard) volume

B. Class 1A Excavation:
1. Excavation for the removal of unsuitable material below subgrade having a bottom width of less than 2.5 m (8 feet), as indicated or directed. Saw cut as necessary. Includes backfilling as specified in Section 02220.

C. Class 1B Excavation:
1. For roadway rehabilitation, sawcutting and removal of existing pavement to neat lines, as indicated or directed.

1.03 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02072 – Selective Demolition - Roadway
D. Section 02170 – Vibration Monitoring and Condition Survey
E. Section 02200 – Earthwork
F. Section 02220 – Excavation, Backfill, and Compaction

1.04 SUBMITTALS
A. Submit the following in accordance with provisions of Section 01300:
1. Permits for disposal of excavated material:
   a. Obtain written permits and releases from owners of property where material will be deposited.
   b. Submit copies of each permit and release from each property owner absolving SEPTA from responsibility in connection with such disposal.

1.05 QUALITY ASSURANCE

   A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications, Section 203

1.06 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 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.

   G. Existing waste conditions:
      1. Contaminated Soils: To be provide with next submittal

PART 2 – PRODUCTS

This Part not used.
PART 3 – EXECUTION

3.01 GENERAL
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.
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 Project Manager, is unstable and constitutes potential slides, and material which comes into excavations for any reason.
   2. Keep the excavation graded to drain seal with smooth-wheeled compaction equipment to prevent subgrade from becoming saturated. Seal the surface at the end of the workday in order to prevent conditions from deteriorating before work can proceed. Temporary drainage structures or channels may be required.

3.02 REMOVAL OF EXISTING PAVEMENTS
A. Under Embankments. Remove existing pavements within 1 m (3 feet) of the finished grade, scarify the underlying base to a depth of 150 mm (6 inches) and recompact.
B. Outside Embankment Limits. Remove existing pavements outside the limit of embankments, as indicated, to neat lines, and backfill with suitable material compacted as specified in PennDOT Publication 408, Specifications, Section 206.3(b).
C. Roadway Rehabilitation. Outline area, cut, and remove existing pavement structure as indicated or directed.

3.03 SLOPES
A. Vary the slopes, if directed, depending on the type of material encountered, in order to obtain satisfactory stability. Remove the material by a method that allows the revised slope lines to be neatly and acceptably trimmed to meet existing conditions.
B. If a slide occurs, notify the Inspector-in-Charge immediately and cease operations in the slide area until directed to resume. Remove slide material and bench of flatten slopes, as directed, to obtain the planned width of roadway.

3.04 EXCAVATION BEYOND ESTABLISHED SLOPE LINES
A. Do not remove or excavate any material beyond the slopes lines indicated, without written authorization.

3.05 TOPSOIL
A. Stockpile topsoil removed from within the excavation or under embankment areas as specified in PennDOT Publication 408, Specifications, Section 801, unless otherwise directed. Replace topsoil that is required on the project and wasted during clearing and grubbing operations at no expense to the Department.
3.06 BRACING AND SHORING
   A. Brace and shore sides of the excavation, as necessary. Remove bracing and shoring when no longer required, unless otherwise indicated or directed.

3.07 SUITABLE MATERIAL REQUIRED FOR EMBANKMENT AND BACKFILL
   A. Haul suitable excavated material for placement in embankment and for backfill. Replace suitable material (PennDOT Publication 408, Specifications, Section 206.2(a)2) that is required on the project and wasted during clearing and grubbing operations at no expense to the SEPTA.

3.08 UNSUITABLE AND SURPLUS MATERIAL
   A. Dispose of unsuitable and surplus material in suitable waste areas obtained as specified in PennDOT Publication 408, Specifications, Section 105.14.

END OF SECTION 02225
PART 1– GENERAL

1.01 DESCRIPTION
A. The work specified in this Section consists of furnishing, placing and compacting aggregate for subbase on completed subgrade or properly prepared foundation to the lines, grades, and dimensions indicated.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02530 – Bituminous Concrete Paving
D. Section 02531 – Bituminous Tack Coat
E. Section 02533 – Concrete Sidewalk

1.03 SUBMITTALS
A. Submit the following in accordance with provisions of Section 01300:
   1. Certificate of Compliance stating that aggregate conforms to Specifications.

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications, Section 350, except as modified herein.
      b. D1556, Test Method for Density and Unit Weight of Soil in Place by the SandCoreMethod.
      c. D2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

1.05 PRODUCT DELIVERY STORAGE AND HANDLING
A. Transport, deliver, and handle aggregate materials in a manner and by those means which will prevent segregation, contamination, and excessive wetting of aggregate.
PART 2 – PRODUCTS

2.01 AGGREGATE
   A. Type C or better, No. 2A Aggregate conforming to PennDOT Publication 408, Specification, Section 703.2.

PART 3 – EXECUTION

3.01 PREPARATION
   A. Inspect completed subgrade. Correct irregularities or soft areas by scarifying, reshaping, and recompaition, or by replacement, as directed by the Project Manager.

3.02 CONSTRUCTION
   A. Use material uniformly graded and containing enough moisture to prevent segregation during stockpiling, hauling, and placing, and to minimize the need for adding water during compaction.
   B. Placement:
      1. Control the elevation and depth of the subbase.
      2. Deposit the material on the prepared area by means of spreaders or other approved method, in a manner which will not cause segregation.
      3. Construct subbase in courses not over 8 inches in compacted depth.

3.03 COMPACTION AND DENSITY
   A. Compact the uniformly spread material to not less than 100 percent of the maximum dry-weight density, which will be determined in accordance with ASTM D698 or ASTM D1557. The in-place density will be determined in accordance with ASTM D1556 or ASTM D2922, where directed, for each 27,000 ft², or less, of each layer of completed subbase. When the material is too coarse to use these methods, determine compaction based on non-movement of the material under the compaction equipment. Proceed with compaction gradually from sides to center, with each succeeding pass uniformly overlapping the previous pass. Continue until the entire area is satisfactorily shaped and compacted.
   B. If stone material does not contain sufficient moisture after placement; add water to obtain proper compaction. Otherwise, remix, reconstruct, or replace the material, as directed.

3.04 SURFACE TOLERANCE
   A. Test the finished surface for irregularities by using a template cut to the required cross section of the surface. Equip the template with metal or other vertical extensions attached to each end, so the bottom of the template will be at the elevation of the top of the surface. Test the cross section for surface irregularities at intervals of not more than 25 ft.
   B. Correct all surface irregularities exceeding ½ in. by loosening the surface and removing or adding material as required. Compact the corrected area and surrounding surface.

3.05 TEST FOR DEPTH
   A. Carefully dig a test hole to the full depth of the completed subbase, where directed by the Project Manager, for each area where subbase is placed.
   B. The Project Manager will measure the depth of the finished base.
C. Where the base is ½ in. or more deficient from the depth indicated, scarify to a 3 in. depth, blend with additional material, recompact, or otherwise correct, as directed by the Project Manager. Additional test holes may be required, if directed to determine the limits of defective areas.

D. After the depth has been measured, backfill test holes with acceptable material and compact.

END OF SECTION 02230
SECTION 02235
SUBGRADE

PART 1– GENERAL

1.01 DESCRIPTION
A. This work is preparation of the roadbed to establish the subgrade.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02220 – Excavation, Backfill and Compaction
D. Section 02280 - Geotextiles
E. Section 02530 – Bituminous Concrete Paving

1.03 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS

This Part not used.

PART 3 – EXECUTION

3.01 GENERAL
A. Form roadbed to the established subgrade elevation and compact to specified density requirements, using equipment specified in Section 02220 – Excavation, Backfill and Compaction.

3.02 DENSITY REQUIREMENTS
A. Compact subgrade to 100% of the determined dry-mass (dry-weight) density. Dry-mass (Dry-weight) density for material in place in the field will be determined, according to PTM No. 106, Method B. In-place density or compaction will be determined, according to AASHTO T 191 or T 310 where directed, for each 2500 m² (3,000 square yards), or less, of completed subgrade. When material is too coarse (more than 20% retained on the 19 mm (3/4-inch) sieve and less than 35% passing the 75-µm (No. 200) sieve, or more than 30% retained on the 19 mm (3/4-inch) sieve) to use these methods, compaction will be determined based on nonmovement of material under compaction equipment specified in
B. Maintain material to within minus 3% of optimum and the optimum moisture content at the

3.03 SUBGRADE REQUIREMENTS

A. Complete, maintain, and protect subgrade in continuous lane construction. Promptly reshape
and recompact, or remove and replace, damaged or unsatisfactory areas before placement
of pavement structure.

B. Install reference grade lines with ample supports, or grade stakes, offset along each side of
the subgrade, to control the elevation. Maintain reference grade lines until after completing
the surface and correcting deficiencies.

C. Check subgrade for grade and slope. Test the finished surface for irregularities by using a
string line stretched tautly, transversely across the subgrade area, between the reference
grade lines. Measure the vertical distance from the string line to the finished grade, at
various points along the string line, from one side of the surface to the other. Test for surface
irregularities at longitudinal intervals of not more than 7.5 m (25 feet).

D. As an alternative or whenever the Project Manager suspects an area is deficient or irregular,
check the finished surface with a template and 3 m (10-foot) straightedge. Test the finished
surface for irregularities by using a template cut to the required cross-section of the surface.
Equip the template with metal or other vertical extensions attached to the top of each end to
support a leveling device for checking the cross slope. The bottom of the template is to be at
the elevation of the top of the subgrade. Use a 3 m (10-foot) straightedge to test for
longitudinal irregularities in the surface. Hold the straightedge parallel to the road centerline
in contact with the surface. Move the straightedge from one side of the surface to the other.
Advance along the surface in 1.5 m (5-foot) increments.

E. Where subgrade is constructed using an automatic grading machine that cuts the subgrade
and is controlled by a reference line or lines, the longitudinal interval for checking the surface
cross-section may be increased to not more than 15 m (50 feet).

F. Where subgrade is constructed using grading equipment controlled by Survey Grade Global
Positioning System (GPS), laser technology, and/or combination thereof, the longitudinal
interval for checking the surface cross-section may be increased to not more than 150 m
(500 feet) provided the requirements of Section 210.3(d) are met.

G. Correct surface irregularities exceeding 12 mm (1/2 inch) by loosening the surface and
removing or adding material as required. Compact the corrected area and surrounding
surface by rolling. Recheck the corrected subgrade area for grade and slope.

3.04 GPS OR LASER-CONTROLLED EQUIPMENT

A. At least 1 week before the preconstruction conference, submit a machine control grading QC
Plan to SEPTA in accordance with Section 1400. As a minimum, the QC Plan must
demonstrate that the grading control equipment meets the performance requirements within
acceptable tolerances.
B. At a minimum, set construction stakes at right angles to the centerline on tangents and radial offsets on curves at 150 m (500 foot) intervals the entire length of mainline. In addition, set a minimum of two constructions stakes on each ramp, on each intersecting roadway, and on projects less than 300 m (1000 feet) in length. Tabulate and provide offsets and elevations of all stakes using Form D-413 to the Project Manager. Rough grade and fine grade stakes will be accompanied by a guard stake for easy identification.

C. Provide control points and conventional grade stakes at critical locations such as, PC’s, PT’s, superelevation points, and other critical points required for the construction of drainage and roadway structures.

D. Provide other points of reference necessary to establish quality control or for verification of accuracy by SEPTA.

E. Provide the same Survey Grade GPS network to the Department as that used during construction. SEPTA will review the network and monitor the project.

F. Check and recalibrate, if necessary, the GPS or laser machine control system at the start of each work day.

G. Test the finished surface at all hinge points and/or centerline, edge of lane, and edge of shoulders on the crosssection at all critical locations and as established in the QC Plan.

H. Correct surface irregularities exceeding 12 mm (1/2 inch) by loosening the surface and removing or adding material as required. Compact the corrected area and surrounding surface by rolling. Recheck the corrected subgrade area for grade and shape.

I. Upon successful quality control testing, notify the Project Manager the subgrade is ready for acceptance. At a minimum, the Project Manager will test the finished surface at all hinge points and/or centerline, edge of lane, and edge of shoulders on the cross-section at a random locations every 150 m (500 feet) for acceptance. Correct all areas exceeding 12 mm (1/2 inch). If more than 10% of all acceptance tests are determined to exceed 12 mm (1/2 inch) in any phase of the project, the Project Manager may require stakes and stringline be established as specified in Part 3.03.

J. Provide all electronic data files used for the construction of the fine-grade of the roadway to the Project Manager.

END OF SECTION 02235
SECTION 02240
ROCK CLASS R-4

PART 1– GENERAL

1.01 DESCRIPTION
A. This work is construction of rock lining of the class indicated.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements

1.03 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS

2.01 MATERIAL
A. General. Acceptable quality; sound; free from structural defects and foreign substances, such as soil, shale, and organic materials. Unless the rock comes from material providing an approved Type A aggregate, listed in Bulletin 14, submit samples to the MTD for petrographic examination for durability before use.
B. Use rock conforming to the following requirements:
   1. No shale seams.
   2. Hard and angular shaped rock with neither width nor thickness less than one-third its length.
   3. Minimum specific gravity of 2.5, as determined according to AASHTO T 85, bulk-saturated, but surface-dry basis.
   4. Each load of rock well-graded, from the smallest to the largest size.
C. Size and Gradation

<table>
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<th>Percent Passing (Square Openings)</th>
<th>Class, Size No. (NCSA)</th>
<th>R-4</th>
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<tr>
<td>Rock Size, millimeters (inches)</td>
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<tr>
<td>1070 (42)</td>
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<td>760 (30)</td>
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<tr>
<td>380 (15)</td>
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<tr>
<td>300 (12)</td>
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<td>100*</td>
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<tr>
<td>230 (9)</td>
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</tr>
<tr>
<td>150 (6)</td>
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<td>15-50</td>
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<td>100 (4)</td>
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<td>50 (2)</td>
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<tr>
<td>Nominal Placement Thickness, millimeters (inches)</td>
<td>460 (18)</td>
<td></td>
</tr>
</tbody>
</table>

* Maximum allowable rock size.

D. Acceptance of gradation will be based upon visual inspection and certification. Provide two samples of rock, at least 4.5 tonnes (5 tons) each or each one-half the total project quantity, whichever is smaller. Provide one sample in place at the construction site and provide the other sample at the quarry. The construction site sample may be incorporated into the work. These samples will be used as a reference for judging the size and gradation of the rock supplied and placed. Certify as to gradation, as specified in PennDOT Publication 408, Specifications, Section 106.03(b)3.

E. Use geotextiles, Class 2, See PennDOT Publication 408, Specifications, Section 735.

**PART 3– EXECUTION**

**3.01 CONSTRUCTION**

A. Prepare the area required for placing the geotextile and rock.

B. This preparation may include, but not be limited to excavating, removing unsuitable material, backfilling, placing embankment, and clearing and grubbing, as specified in PennDOT Publication 408, Specifications, Section 201.3. Place the geotextiles, as specified in PennDOT Publication 408, Specifications, Section 212.3(c).

C. Carefully place the rock on the geotextiles to produce an even distribution of pieces, with a minimum of voids and without tearing the geotextile. Place the full course thickness in one operation in a manner to prevent segregation and to avoid displacement of the underlying material. Do not place rock in layers, by dumping into chutes, or by similar methods likely to cause segregation or geotextile damage. Rearrange individual rocks, if necessary, to ensure uniform distribution.

END OF SECTION 02240
SECTION 02270
SOIL EROSION AND SEDIMENTATION CONTROL

PART 1– GENERAL

1.01 DESCRIPTION
A. The work specified in this Section consists of all labor, materials, equipment and services necessary to furnish, fabricate, install, maintain, and remove soil erosion and control devices as indicated on the Contract Drawings or as directed by the Project Manager.
B. The work includes all incidental and miscellaneous items not specified under another section but required for the work of this Section, whether or not specifically referred to herein.
C. This Section includes, but is not limited to, the following items:
   1. Inlet Protection
   2. Silt Barrier Fence
   3. Erosion Control Blanket
   4. Temporary Seeding and Mulching
   5. Temporary dewatering sumps and sediment filter bags for pumped water
   6. Construction Entrance
   7. Tree Protection
   8. Tree Trimming and Selective Tree Removal
   9. Unforeseen Water Pollution Control
   10. Maintenance, inspection, and removal of all sediment and erosion control devices

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 - General Requirements
C. Section 01500 - Construction Facilities and Temporary Controls
D. Section 02070 – Selective Demolition – Bridge
E. Section 02072 – Selective Demolition - Roadway
F. Section 02120 – Clearing and Grubbing
G. Section 02200 – Earthwork
H. Section 02220 – Excavation, Backfill, & Compaction
I. Section 02280 - Geotextiles
J. Section 02900 – Seeding and Mulching

1.03 SUBMITTALS
A. Submit the following in accordance with Section 01300:
   1. Product Data:
      a. Inlet Protection
      b. Silt Barrier Fence
      c. Erosion Control Blanket
d. Temporary Sumps and Filter Bags  
e. Tree Protection  
f. Temporary seed mixture

1.04 QUALITY ASSURANCE  
A. The work covered in this Section shall be in accordance with the requirements and procedures of the following documents: conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.  
1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):  
a. PennDOT Publication 408, Specifications  
b. PennDOT Publication 72, Roadway Construction Standards  
2. Commonwealth of Pennsylvania Department of Environmental Protection (PADEP), Office of Water Management: Erosion and Sediment Pollution Control Program Manual  
3. Pennsylvania Code, Title 25 Environmental Protection, Chapter 102 Erosion and Sediment Control  
4. City of Philadelphia Stormwater Regulations  
B. Regulatory Requirements: Comply with applicable portions of federal, Commonwealth of Pennsylvania and City of Philadelphia environmental regulations pertaining to soil erosion and sediment controls.  
C. Preconstruction Conference: Prior to any earth disturbance, conduct a conference at the Project with a representative of the Philadelphia Water Department Erosion and Sediment Control Inspection Group.

PART 2 – PRODUCTS  
2.01 GEOTEXTILE  
A. Geotextile for stabilized construction entrances: In accordance with PennDOT Publication 408, Specifications, Section 735, Class 4, Type B.

2.02 INLET PROTECTION  
A. In accordance with PennDOT Publication 408, Specifications, Section 860

2.03 SILT BARRIER FENCE  
A. In accordance with PennDOT Publication 408, Specifications, Section 865.

2.04 EROSION CONTROL BLANKET  
A. In accordance with PennDOT Publication 408, Specifications, Section 806.2(a).2.

2.05 TEMPORARY SEED AND MULCH  
A. Seed: in accordance with PennDOT Publication 408, Specifications, Section 804.  
B. Mulch for seeded areas: straw, wood fiber or pellet mulch in accordance with PennDOT Publication 408, Specifications, Section 805.  
C. Fill spout size to accommodate a 4” hose. Provide attached strapping to secure hose and prevent pumped water from escaping.
2.06 DEWATERING SUMPS
   A. In accordance with PennDOT Publication 408, Specifications, Section 855.

2.07 SEDIMENT FILTER BAGS
   A. In accordance with PennDOT Publication 408, Specifications, Section 855.

2.08 CONSTRUCTION ENTRANCE
   A. In accordance with PennDOT Publication 408, Specifications, Section 849.

2.09 TREE PROTECTION
   A. In accordance with PennDOT Publication 408, Specifications, Section 811.

2.10 TREE TRIMMING AND SELECTIVE TREE REMOVAL
   A. In accordance with PennDOT Publication 408, Specifications, Section 810.

2.11 UNFORESEEN WATER POLLUTION CONTROL
   A. In accordance with PennDOT Publication 408, Specifications, Section 845.

PART 3–EXECUTION

3.01 GENERAL
   A. The Contractor shall incorporate, as the work progresses, all permanent and temporary slope protection and erosion control features at the earliest practicable time. Temporary erosion control measures shall be used to correct conditions that develop during construction that were not foreseen during the design stage.
   B. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff to adjacent properties, streets, walkways and storm sewers, according to the Soil Erosion and Sediment Control Drawings.
   C. Inspect, repair and maintain soil erosion and sediment control measures during construction until permanent vegetation has been established.
   D. Materials not used in construction will be removed from the site as early as possible. Dewatered sediment cleaned from the silt fence barriers will be disposed of off-site.
   E. During construction, the temporary silt fence barriers and inlet protection will be cleaned at regular intervals to avoid overflows and prevent loss of more than 30% of their filtering capacity.
   F. Remove soil erosion and sediment control measure and restore and stabilize areas disturbed during removal.

3.02 PREPARATION
   A. Coordinate schedule, and attend pre-construction meeting at the site with regulatory agencies before the start of construction.
   B. Stockpile erosion control materials on site before any work commences.
3.03 CONSTRUCTION REQUIREMENTS

A. Furnish all materials, labor, and equipment required to construct erosion control devices in accordance with the Drawings and applicable reference standards.

B. Construct or install soil erosion and sediment control measures in accordance with all applicable regulatory requirements.

C. Minimize the project site areas which are disturbed by the execution of work and left unstabilized.

D. Immediately remove sediment spilled, dropped, washed or tracked onto the existing roads or streets. Provide a mechanical street sweeping machine on a regular basis, manual sweeping, or maintenance as directed by the Owner to remove sediment from surfaces outside the work area.

3.04 TEMPORARY SEEDING AND MULCHING

A. Where not specified on the Drawings, apply temporary seed and mulch at the rates specified in PennDOT Publication 408, Specifications, Section 804, Formula E.

3.05 EROSION CONTROL BLANKET

A. Install blanket on all disturbed soil slopes. Install in accordance with manufacturer’s instructions.

3.06 FIELD QUALITY CONTROL

A. Inspection: Inspect and maintain all erosion and sediment control measures on a weekly basis, before anticipated precipitation events and after precipitation events.

END OF SECTION 02270
SECTION 02280
GEOTEXTILES

PART 1 – GENERAL

1.01 DESCRIPTION
A. This work is furnishing and installing geotextiles for the class specified.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02200 - Earthwork
D. Section 02270 – Soil Erosion and Sedimentation Control

1.03 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereunto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS

2.01 MATERIALS
A. Use geotextiles as specified in PennDOT Publication 408, Specifications, Section 735 for the specified class and type.
B. For bedding use open-graded stone conforming to the requirements of Type C or better aggregate, as specified in PennDOT Publication 408, Specifications, Section 703.2, except do not use No. 2-A or No. 10 coarse aggregate.
C. Use steel securing pins 460 mm long x 4.75 mm (18 inches long by 3/16 inch) in diameter, pointed at one end, and with a 40 mm (1 1/2-inch) washer head at the other end. If permitted, alternate securing devices may be used. Certify as specified in PennDOT Publication 408, Specifications, Section 106.03(b)3.
D. Use cover material as specified or indicated.
E. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M288 and the following, measured per test methods referenced:
   1. Survivability: Class 1; AASHTO M288.
   2. Apparent Opening Size: No. 70 sieve, maximum; ASTM D4751.
   3. Permittivity: 0.1 per second, minimum; ASTM D4491.
   4. UV Stability: 50 percent after 500 hours’ exposure; ASTM D4355.
PART 3 – EXECUTION

3.01 GENERAL
   A. Remove and replace fabric areas damaged during construction. Lap or sew replaced fabric as specified for the class of fabric used. Do not allow traffic or construction equipment on the fabric.

3.02 CLASS 1 – SUBSURFACE DRAINAGE
   A. Provide smooth side and bottom trench surfaces so the fabric does not bridge depressions in the soil and is not damaged by rock projections. Use fabric of a width to permit a minimum trench-width overlap across the backfill at the trench top. Lay the fabric flat in the prepared trench without stretching. Lay the top of the fabric back on the sides to allow for the placement of the aggregate backfill and pipe. Overlay ends of rolls an amount equal to the trench width before placing fabric. Fill pockets or cavities in the trench bottom or sides with acceptable granular material to prevent distortion or damage to the fabric.
   B. Backfill aggregate and install pipe in a manner to prevent damage to the fabric. Compact aggregate and overlap the fabric across the trench top. Do not allow the fabric to be exposed for more than 2 weeks without covering with aggregate.

3.03 CLASS 2 – EROSION CONTROL
   A. Use Type A or Type B fabric as indicated or specified. Remove vegetation, large stones, and other debris from the area to be protected and grade the surface to a relatively smooth condition. Undercut areas of soft material and replace with acceptable compacted material, as directed.
   B. Lay the fabric on the prepared area in a loose and unstretched condition to minimize shifting, puncturing, or tearing the fabric. Join adjacent edges and ends with a folded seam and sew using a single lock-type stitch seam or a double chain type stitch seam equivalent in strength to the fabric tensile strength. Sewing may be done on-site or by the manufacturer. Overlap only when directed. Provide a minimum overlap of 300 mm (1 foot). For underwater placement, overlap a minimum of 1 m (3 feet). Offset adjacent roll ends a minimum of 1.5 m (5 feet) when lapped.
   C. Lay and overlap the fabric in the direction shown in Table A for the indicated use.
   D. Anchor the fabric in place by securing pins or other acceptable methods, along sewn seams or overlaps, at the spacing shown in Table B. Place securing pins on a maximum 1.8 m (6 foot) grid on the unsewn or unlapped portions of the fabric.
   E. Eliminate securing pins for slopes flatter than 1:6 (6:1), provided that aggregate, rock, or other acceptable means are used to secure the fabric.
TABLE A
Fabric Placement

<table>
<thead>
<tr>
<th>Operation</th>
<th>Slope Stabilization Runoff Protection and Internal Seepage Piping</th>
<th>Stream Slope Protection</th>
<th>Wave Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction of fabric laying</td>
<td>Up and down (parallel with slope direction)</td>
<td>Parallel to stream flows from upstream to downstream</td>
<td>Up and down (parallel with slope direction)</td>
</tr>
<tr>
<td>Overlap direction</td>
<td>Upslope over downslope</td>
<td>Upstream over downstream and upslope over downslope</td>
<td>Upslope over downslope</td>
</tr>
</tbody>
</table>

TABLE B
Securing Pin Spacing *

<table>
<thead>
<tr>
<th>Slope</th>
<th>Steeper than 1:3 (3:1)</th>
<th>1:4 (4:1)</th>
<th>Flatter than 1:4 (4:1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin Spacing along sewn seams or overlaps</td>
<td>0.6 m (2 feet)</td>
<td>1 m (4 feet)</td>
<td>1.5 m (5 feet)</td>
</tr>
</tbody>
</table>

*Place additional pins to secure unlapped portions as specified.

F. Cover the fabric with the covering material as soon as possible. Do not expose the fabric for more than 4 weeks for Type A and 2 weeks for Type B. Prevent slippage of the covering material on the fabric.

G. Do not drop rocks, 600 mm (2 feet) or larger in dimension, directly on the fabric from a height greater than 300 mm (1 foot). Do not allow the rock placement procedure to puncture or damage the fabric. Use a minimum 150 mm (6-inch) layer of bedding stone and a greater drop-height combination if the combination produces the placement, thickness, gradation and fabric integrity requirements, and if permitted.

3.04 CLASS 3 – SEDIMENTATION CONTROL

A. Use Type A or B fabric as indicated or specified. Install as specified in PennDOT Publication 408, Specifications, Section 865.3.

3.05 CLASS 4 – LAYER SEPARATION (TYPE A)

A. Use to separate the subgrade and other layers. Place the fabric on a prepared subgrade area covering the full width of the subbase layer being protected. Place fabric in a loose and unstretched condition to minimize shifting, puncture, and/or tearing of the fabric. Overlap fabric roll-ends and edges a minimum of 300 mm (12 inches) with adjacent material. Place subbase material within 2 weeks after placement of fabric to minimize exposure. Place subbase material in a manner to minimize slippage of the fabric. Use steel securing pins, as specified in Part 2 – Products, at a maximum spacing of 1.8 m (6 feet) if excessive slippage occurs.

3.06 CLASS 4 – STABILIZATION (TYPE B)

A. Fine grade the subgrade as specified in Section 02235, Part 3.03, as indicated, and in compliance with the cross sections. Remove any object that may puncture the geotextile. Roll out the geotextile over the prepared subgrade as indicated. Place the geotextile free of wrinkles. Do not drag the geotextile on the ground during placement or handling. Overlap parallel rolls or intersecting rolls a minimum of 610 mm (2 feet) in the direction of fill. For curves fold and overlap the geotextile in the direction of the turn. Do not allow any equipment
directly on the geotextile until it is covered to full plan depth of subbase. Do not back dump the subbase material directly onto the geotextile. Place subbase material by back dumping then spread the subbase ahead of all equipment at full plan depth. Compact the subbase material with a roller in static mode, if directed. Fill any wheel ruts that form during construction with additional subbase to maintain plan profile. Do not remove the wheel ruts by blading the wheel ruts level.

3.07 CLASS 4 – REINFORCEMENT (TYPE C)

A. Section 02280, Part 3.06 except as follows: For a subgrade with a CBR value of 0.5 or lower, overlaps must be stitched. Use a 401 lock chain stitch seam with a 100 mm (4-inch) lap.

END OF SECTION 02280
SECTION 02290
GEOGRIDS

PART 1 – GENERAL

1.01 DESCRIPTION
A. This work is furnishing and installing geogrids for the class and type specified.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02220 – Excavation, Backfill and Compaction
D. Section 02280 - Geotextiles

1.03 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS

2.01 GEOGRID
A. PennDOT Publication 408, Specifications, Section 738 for the class and type indicated.

2.02 BACKFILL
A. Backfill for Class 1 Geogrids
   1. Mechanically Stabilized Earth (MSE) Walls
      a. Provide backfill for MSE walls consisting of AASHTO No. 8 coarse aggregate, Section 703.2, in areas that require free draining material or in areas that are at or below the 100 year flood elevation. For all other areas of MSE walls provide backfill meeting the following requirements:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2 inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 40</td>
<td>0-60</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-10*</td>
</tr>
</tbody>
</table>

* Determination of the fines content (minus No. 200 sieve material) for MSE wall backfill must be determined by wash test according to PTM No. 100. This is in addition to PTM No. 616

b. Provide backfill meeting the quality requirements of Type C coarse aggregate or better as specified in Section 703.2(a), Table B, except provide materials free of clay lumps, friable particles, coal and coke. Do not use metallurgical slag or cinders.
c. Provide backfill with a maximum plasticity index (PI) of 3 as determined in accordance with AASHTO T 89 and T 90. Provide backfill materials with a pH between 5.0 and 9.0, determined in accordance with AASHTO T 289.

d. Provide backfill with an angle of internal friction of not less than 34 degrees as determined in accordance with AASHTO T 236 on the backfill sample portion that is finer than the No. 8 sieve. Coarse aggregate meeting the requirements of Section 703.2 does not require testing for angle of internal friction. Prepare the shear strength test sample by substituting material coarser than the No. 8 sieve with material that passes the No. 8 sieve but is retained on the No. 10 sieve. The percentage of material finer than the No. 10 sieve must remain as proportioned in the original sample prior to substitution. Shear testing may be performed on samples containing material larger than the No. 8 sieve if the shear device conforms to AASHTO T 236, Sections 5.4 and 5.5.

2. Geosynthetic Reinforced Soil (GRS) Slopes

a. For GRS slopes that require a vegetated face, provide a minimum of 1.0 foot of backfill at the face of the slope (measured perpendicular to the slope face) that meets the requirements of Section 206.2(a)1.a, and that has a pH between 5.5 and 7.5 determined in accordance with AASHTO T 289.

b. For all other areas of GRS slopes with vegetated faces, and all other GRS slope types, provide backfill with a pH between 5.0 and 9.0 as determined in accordance with AASHTO T 289, and unless indicated otherwise, meeting one of the following material types:

1) Soil meeting the requirements of PennDOT Publication 408, Specifications, Section 206.2(a)1.a

2) Well-graded granular material meeting the following requirements:

```
<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 inch</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>50-100</td>
</tr>
<tr>
<td>No. 40</td>
<td>15-55</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-35</td>
</tr>
</tbody>
</table>
```

c. Provide backfill exhibiting an angle of internal friction meeting design requirements, determined in accordance with AASHTO T 236, on the portion finer than the No. 8 sieve. Prepare the shear strength test sample by substituting material coarser than the No. 8 sieve with material that passes the No. 8 sieve but is retained on the No. 10 sieve. The percentage of material finer than the No. 10 sieve must remain as proportioned in the original sample prior to the substitution. Shear testing may be performed on samples containing material larger than the No. 8 sieve if the shear device conforms to AASHTO T 236, Sections 5.4 and 5.5.

B. Backfill for Class 2 and Class 3 Geogrids

1. AASHTO No. 8 coarse aggregate, AASHTO No. 57 coarse aggregate, or PennDOT No. 2A coarse aggregate, Section 703.2, and as specified or indicated.

2.03 CLASS 4, TYPE A GEOTEXTILE

A. PennDOT Publication 408, Specifications, Section 735.
PART 3 – EXECUTION

3.01 GENERAL
A. Prepare surface as indicated or required. Place geogrid to the vertical spacing, lengths and areas indicated. Provide overlaps as specified. Place geogrids flat and free of wrinkles, stretching and anchoring as necessary. Do not allow traffic or equipment on the geogrid until it has been covered with one lift (8 inch loose layer) of backfill. Dump backfill of the type specified on top of the geogrid and then blade material across the grid to the required lift thickness. Maximum backfill drop height is 3 feet. If using tracked equipment to spread backfill, do not cross track or make sudden turns that result in deforming or damaging the geogrid. Compact backfill as specified in PennDOT Publication 408, Specifications, Section 206.3 or as specified. Reject all geogrids with defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, storage, or installation as determined by the Project Manager. Replace damaged geogrid at no additional cost to the Department.

3.02 HANDLING AND STORAGE
A. At a minimum, follow ASTM D 4873 for identification, storage, and handling of geogrid. Provide clear identification to every roll of geogrid that provides identification of product designation, the manufacturer's name, lot number, material quantity, and clearly differentiates between rolls of similar geogrid. Protect all geogrid from direct sunlight, ultraviolet rays, temperatures greater than 140F, mud, dirt, dust, and debris.

3.03 CLASS 1 – UNIAXIAL GEOGRID REINFORCEMENT
A. Place all uniaxial geogrid in the direction of primary reinforcement (machine or roll direction). The maximum allowable vertical spacing of geogrid is 2 feet for MSE wall applications, and 18 inches for GRS slope applications and any other reinforcement applications. Overlap adjacent layers of geogrid as indicated or required, but in no case less than 3 inches. For concave wall or slope faces maintain the minimum overlap for 75 percent of the length of the geogrid from the wall or slope face edge of the geogrid. Do not splice or overlap geogrids in the primary reinforcement (machine or roll) direction.

3.04 CLASS 2 AND CLASS 3 – BIAXIAL GEOGRIDS
A. Prepare subgrade or foundation surface flat, smooth and level, free of any sharp protrusion or debris. Place a layer of Class 4, Type A geotextile on top of the prepared subgrade before placement of geogrid. Overlap edges of geotextile and geogrid (both machine/roll and cross machine/cross roll directions) a minimum of 1 foot. Maximum vertical spacing of geogrid is 12 inches.

END OF SECTION 02290
SECTION 02400
SOILS MANAGEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work of this Section includes, but is not limited to the testing, handling, storage, transportation, and disposal of excavated soils.

1.02 RELATED WORK

A. All appropriate Sections of Division 1, Division 2, and Division 3 of these Specifications.

1.03 JOB CONDITIONS

A. General Contractor shall stockpile, secure, contain, control and cover all excavated soils. Soils from separate work areas shall be segregated and not mixed soils.

B. General Contractor shall provide the services of a qualified geotechnical/environmental consultant to conduct soil sampling, and laboratory chemical analysis to establish soil waste disposal requirements in compliance with Pennsylvania Department of Environmental Protection (PADEP) and defined here-in. All work shall be conducted or supervised by a registered Professional Engineer or Professional Geologist having experience classifying and managing surplus soils in Pennsylvania.

1. Each separate soil pile shall be tested separately.

C. Surplus clean fill shall be managed according to the PADEP Management of Fill Policy and SEPTA’s Soil Management Plan. Material designated as clean fill shall not be wasted in quarries or residential properties. SEPTA prefers to send clean fill to the following locations or reuse on site:

1. Clean Earth of Philadelphia as Historic Fill


D. All soils classified as residual waste shall be disposed of at a certified PADEP soil disposal facility.

E. Soils will need to be sampled, profiled and accepted by a disposal facility prior to removal from site for disposal. PID screening is not sufficient. SEPTA prefers to dispose of petroleum contaminated soils at Clean Earth of Philadelphia. ALL SAMPLING AND PROFILING OF SOILS WILL BE COMPLETED OR SUPERVISED BY A PROFESSIONAL GEOLOGIST (ENVIRONMENTAL CONSULTANT) OR ENGINEER EXPERIENCED IN PERFORMING THIS TYPE OF WORK. The Environmental consultant will document sampling results in a tabular format in a letter report to SEPTA’s Project Manager before soil is removed from the project site.

1.04 SUBMITTALS

A. General Contractor shall provide documentation of:

1. Qualification of testing consultant;

2. A letter report that details soil management activities including, due diligence, sampling, laboratory results summary table and laboratory reports including the copies sample chain of custody;
3. Certificate of waste soil characteristics;

4. Certificate of acceptance of PADEP certified landfill or soil recycling facility.

B. The Contractor shall submit proof of qualifications for its proposed transportation contractor(s) for excavated soils and liquids in accordance with all Local, Federal Laws, and contract documents.

C. The Contractor shall submit proof of qualifications for its proposed disposal/recycling facility(ies) for soils and liquids to be removed from the site in accordance with all Local, Federal Laws, and contract documents.

D. The Contractor shall provide SEPTA with all records including manifests and certificates of disposal for all excavated 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 the contract documents and SEPTA.

3.02 EXCAVATED SOILS

A. The Contractor shall perform excavation of soils in accordance with Specification Section 02220.

B. The Contractor shall hire an environmental Consultant to develop a project soil management plan. The soil management plan is intended to comply with the PADEP Management of Fill policy and applicable State and Federal regulations. The plan shall include sampling of soils that are to be removed from the site, determination if soils meet the PADEP clean fill standards or if they are residual waste. Sampling shall include sufficient characterization that material can be profiled for disposal as residual waste if needed. The Contractor’s Consultant shall prepare a letter report documenting their sampling plan and characterization of soils as clean fill or residual waste. The Consultant shall advise the Contractor and then the Contractor shall advise SEPTA of the soils condition and proposed management and wasting of surplus fill. SEPTA will not accept wasting of clean fill in quarries. The contractor will need to provide SEPTA with acceptable alternatives for the wasting of clean fill.

C. On-Site Storage

1. SEPTA will not allow temporary staging of soils generated as part of excavation. The Contractor shall direct load all excavated soils resulting from excavation activities that cannot be reused onsite for offsite transportation and disposal.

D. Loading

1. The Contractor shall furnish all equipment necessary for loading of excavated 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 excavated 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 excavated soils shall be inspected by the Contractor following loading. No dripping or leaking of any quantity of material is allowed. Soils that contain excavated 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 excavated soil adheres to its wheels or undercarriage to avoid tracking of soils. Exteriors of all vehicles must be cleaned prior to leaving the site.

E. Transportation

1. All excavated soils must be transported off-site only to the facility(ies) pre-approved by SEPTA.

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 excavated soils and liquids removed from the Project. This includes having a Pennsylvania Department of Environmental Protection (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.

   a. The Contractor shall minimize storage of excavated soils on SEPTA property by transporting excavated soils directly to the approved disposal facility when schedule and conditions prove practicable.

   b. 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.

   c. 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.

F. Disposal

1. Excavated 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, System Safety Department.
2. Disposal of excavated 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, of Philadelphia, Inc. as the proposed disposal facility for soils classified as residual waste, removed from the project and requiring off-site disposal. The Contractor shall assume that the soils to be generated during Work of the Contractor shall be classified as a residual waste for disposal purposes. 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. The Contractor shall be responsible for the application process in establishing landfill approval at a facility as approval by SEPTA System Safety. In addition, the Contractor may submit alternative proposed waste disposal facilities subject to the requirements of these Specifications. Disposal shall not occur until written approval is provided by SEPTA, System Safety Department.

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.

G. 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.

2. If any water appears at the bottom of the excavation, it may not be discharged into the storm sewer. When possible, all water should be left in place. If necessary, water may be removed along with the soil and placed into containers for future disposal.

3. If water in the excavation can no longer be managed by excavation equipment, the Contractor shall pump and collect it in 55-gallon drums or other suitable watertight containers for further testing and disposal by the Contractor at a SEPTA-approved facility, at no additional cost to SEPTA.

4. All water used for cleaning of the Contractor's equipment shall be 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.

5. The 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.
PART 1 - GENERAL

1.01 SUMMARY

A. The Work of this Section includes technical requirements for accomplishing the trackwork as shown and described in the Contract Documents.

1.02 DESCRIPTION OF WORK

A. The Work of this Section includes, but is not necessarily limited to, the following:

1. Laying Steel Support Tie, Section 3.03.
2. Steel Support Tie, Section 02472.
3. Steel Rail, Section 02466.
4. Rail Welding, Section 02468.
5. Installation of rail fastening systems, including Section 3.08; and
   a. Rail Plate and Galvanized Anchor Plate, Section 02474
   b. Rail Fasteners, Section 02459
6. Rail Installation, Section 3.09.
7. Compromise Rail Joint Assembly, Section 02476.
8. Rail Boot, Section 02470.

1.03 REFERENCE STANDARDS

A. SEPTA Regional Railroad Track Division SMW-100, Track Department Manual – Part 3 - CWR Plan for thermal adjustment of rail strings.


1.04 RELATED SECTIONS

A. Division 1 of these Specifications.
1.05 SUBMITTALS
A. Contractor shall submit the following:
   1. Catalog cuts, drawings, specifications, manufacturer’s data, and manufacturer’s recommendations for all materials furnished by Contractor.
   2. Site Specific Work Plans.

1.06 QUALITY ASSURANCE
A. Provide Field Engineering in accordance with Section 01050 of these Specifications to reference proposed elevations, lines, and grades of tracks under construction.
B. Quality Assurance Program: Contractor shall refer to Section 01400, "Quality Requirements" and conform to the requirements of the Quality Assurance Program.

PART 2- PRODUCTS

2.01 STEEL SUPPORT TIE
A. Section 02472, “Steel Support Tie”.

2.02 RUBBER BOOT
A. Section 02470, “Rail Boot”.

2.03 CLIPS, INSULATORS, WELD ON SHOULDERS
A. Section 02459, “Rail Fasteners”.

2.04 RAILS
A. Section 02466, “Steel Rail”.
B. Section 02476, “Compromise Rail Joint Assembly”.

2.05 RAIL PLATE AND GALVANIZED ANCHOR PLATE
A. Section 02474, “Rail Plate and Galvanized Anchor Plate”.

PART 3- EXECUTION

3.01 PREPARATION
A. Submit all Site Specific Work Plans.
B. Submit all other required material data, shop drawings, and/or specifications for track material to be used on this project.

C. Obtain all Permits and Licenses required and give written notices necessary for and incidental to the due lawful prosecution of the Work.

D. Contractor shall be responsible for making all arrangements for access to the work site, and storage and security of materials and track/construction equipment.

3.02 MOVING, STORAGE, AND HANDLING OF MATERIALS

A. Contractor shall take care with all materials moving, loading, transporting, unloading, storing, and handling during installation, such that the materials are kept clean and free from injury. Store materials above ground on platforms, skids or other supports, and cover and protect from corrosion and/or deterioration as required.

B. Contractor shall replace all items that are damaged, lost, or stolen throughout the course of the project at no additional cost to SEPTA.

3.03 LAYING STEEL SUPPORT TIE

A. Stone sub-base shall be fine graded. Compaction and elevation of the finished subgrade shall be demonstrated to the Project Engineer for acceptance prior to placement of steel ties.

B. Support ties shall be placed on the stone sub-base after it has been graded, compacted, and approved by Resident Engineer.

C. All steel support ties shall be provided by the Contractor in conformance with Section 02472 - Steel Support Tie.

D. Care shall be taken when handling ties such that ties are not excessively damaged. Only proper tools for handling ties, specifically designed for that purpose, shall be used.

E. Install steel support ties as indicated on the Contract Drawings and as specified herein.

F. Steel Support Ties shall be placed at a maximum spacing of 6 feet. Closer spacing may be required to establish track alignment.

G. During the pour of track slab, place concrete with appropriate vibration to fill all corners, gaps, and voids underneath the support tie.

3.04 RAIL WELDING PREPARATION

A. Prepare rail ends as described in the AREMA Railway Manual. Use angle grinders with wire brush attachments to remove scale as necessary, and cover rail ends to prevent further scale from building up on the surfaces before welding.

B. Weld all rail lengths with the brand facing the same side for the entire length of each welded string.

C. Use abrasive saw for cropping rail. Torch cutting will not be permitted.
D. A straightening press may be used in the welding production line to help achieve or improve the alignment tolerances. Misalignment tolerances shall conform to the requirements of the AREMA Manual for Railway Engineering. Rails with excessive droop or local end condition, or other alignment defects which cannot be straightened to reasonably meet these requirements, shall be cropped as required prior to welding.

3.05 RAIL WELDING

A. Welded strings shall be fabricated using the Electric-Flash Butt (EFB) Welding process in accordance with AREMA Manual for Railway Engineering, Chapter 4, Section 3.10, General Specification for In-Track Welding Using Electric Flash Butt (EFB) Welding Equipment, and as specified herein.

B. Finishing tolerances shall be in accordance with AREMA Specifications except: finish bottom of the rail base to plus or minus 0.010 inch of the highest rail.

C. All notches created by offset conditions or twisted rail shall be eliminated by grinding to blend with adjacent surface.

D. Whenever the finishing process involves knot cutting or heavy grinding which is done immediately following welding to prevent metallurgical damage, complete the grinding at the normally high temperature when a production line is interrupted. Remove all fins due to grinding drag.

3.06 INSPECTION

A. All welds giving indication of fault by ultrasonic inspection or failing to comply with the misalignment tolerances, or rejected by the Project Manager for any reason, shall be saw cut out a minimum of twelve (12") inches on either side of the rejected element, and the joint immediately re-welded, and re-inspected for Resident Engineer’s approval, at no additional cost to SEPTA.

3.07 RAIL PLATE AND GALVANIZED ANCHOR PLATE

A. The rail plate shall be installed during the concrete deck and approach slab pour.

B. The welding of the rail plates to the galvanized anchor plates shall be on areas free of zinc. The zinc coating should be removed at least one inch from either side of the intended weld zone by grinding back the zinc coating. The welder shall take the necessary safety measures to minimize fume inhalation when welding adjacent to the zinc coating.

C. After the welding of the rail fastening system tie plates to the galvanized anchor plates, the contractor shall repair the galvanized surface in accordance with ASTM A780 Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

3.08 RAIL FASTENERS

A. Shall be installed per the manufacturer’s installation recommendations.

B. Insulators shall be used with the rail boot to prevent any tearing of the rubber boot.
3.09 RAIL INSTALLATION

A. Rails shall be gauged and fastened to steel support ties in the roadway section and fastened to a Pandrol tie plate attached to steel anchor plate in approach slab and deck slab using devices provided by the Contractor in conformance with Section 02459, “Rail Fasteners”.

B. Track gauge shall be 62 ¼” measured at 5/8” below the head of rail. Allowable tolerance is -0, + 1/8”.

C. Striking rails with spike mauls, sledge hammers or other steel tools which may lead to fractures is prohibited. Only appropriate rail handling tools shall be used, and in the method they are intended to be used. Rails struck with steel tools causing nicks or other deformations shall be replaced at no additional cost to SEPTA.

D. Rail strings shall be handled so that excessive bending does not occur. Rails kinked or bent shall be replaced at no additional cost to SEPTA.

E. All CWR shall be installed and anchored in accordance with SEPTA SMW-100 Part 3 - CWR Plan. The acceptable Rail Neutral Stress Temperature is 95°F to 110°F. Strings installed and anchored outside of this range shall be thermally adjusted in accordance with the CWR Plan prior to final acceptance of the work.

3.10 RAIL BOOT AND CUFF INSTALLATION

A. Install rail boot and cuff as indicated on the Contract plans and specifications.

B. Rail boot and cuff and binder clip or binder device proposed by the contractor should all be compatible with the rail boot dimension. The rail boot dimension at the base of the rail should match the rail seat of the support ties and rail plates.

C. The rail contractor shall submit procedures for the installation of the rail boot and cuff for approval by the resident engineer. Rail boot procedures shall include the method required to perform near perpendicular cutting of rail boot and procedure for fusion welding of rail boot and cuff.

D. Minimum gap tolerances between rail boot ends shall be 1/8-inch at the top surface and a 1/4-inch at the web and base of the rail. Gaps between rail boot ends shall be filled up with approved sealant material except at the underside of the rail base to allow drainage to pass through the rail boot splices.

E. Before the installation of the cuff, the Resident Engineer shall approve the quality and matching of the rail boot end cuts at the joints. End of cuffs and the space between rail boot and cuff should be filled in accordance with manufacturer’s recommendations.

F. Longitudinal gap between the rail and the rail boot material is not allowed during the placement of concrete or new slab second pour concrete.

G. Installation of rail boot (including cuff installation) shall be supervised by the Contractor’s foreman, who shall be trained and certified in accordance with the supplier’s requirements.
3.11 COMPROMISE RAIL JOINT ASSEMBLY

A. Compromise joints shall be installed so opposite rail joints are staggered at least 2 ft. or as noted in construction documents.

B. When joining rails of differing sizes with a compromise rail joint assembly, it shall be fitted so that the top of rail surface and the gauge face of the rails to be connected are held in alignment.

C. Bars must be installed on the correct side of rails as indicated by markings denoting GAUGE SIDE/FIELD SIDE.

D. Bolt sets shall be installed in all assembly bolt holes. Driving of bolts will not be permitted. All bolts shall be tightened to a tension of between 20,000 and 30,000 lbs.

E. In the event it is necessary to provide additional bolt holes, it shall be done only by drilling with a rail drill of appropriate size; no other method will be permitted.

F. Each compromise rail joint assembly shall be lubricated by spraying lubricating compound behind each joint bar as part of the installation procedure.

3.12 TRACK SURFACE AND ALIGNMENT

A. Survey Control:

1. Horizontal and vertical control points shall be established a minimum of every 25’ prior to placement of the tracks. These points shall be preserved throughout construction and referenced to the proposed track alignments such that final construction can be verified to conform to the Contract Documents.

B. Horizontal Alignment:

1. Upon completion of the final track lining, the tracks shall be within 1/4” of the proposed alignments.

2. Deviation of the mid-offset on a 62’ line in tangent shall measure no more than 3/16” in either direction and vary no more than 1/4” within 62’.

3. The mid offset on a 62’ chord in curved track shall deviate no more than 3/16” from uniformity and vary no more than 1/4” in the full body within 62’.

4. The mid offset on a 31’ chord in spirals shall increase/decrease at a uniform rate such that the rate of change does not deviate more than 1/8” from uniformity.

C. Vertical Alignment, Cross Level, and Superelevation:

1. Upon completion of the final track surfacing the rail elevations shall be within 1/4” of the proposed elevations.

2. Rails in tangent track shall be set level across heads of rails measured in a plane perpendicular to the centerline of track. Allowable cross level deviation from zero shall not exceed 3/16”, and variation in cross level shall not exceed 1/4” in any 62’.
3.13  FIELD QUALITY CONTROL

A. Contractor shall demonstrate all trackwork conforms to the tolerances listed in this Specification.

B. Contractor shall protect and replace as necessary all field marks used for reference during construction, and demonstrate to the SEPTA Project Manager, or representative compliance to dimensions shown on approved drawings and described in this Specification.

3.14  ADJUSTMENT AND CLEANING

A. Prior to final acceptance and concrete pours, Contractor shall make any final adjustments to the trackwork required such that construction tolerances noted in this Specification are met and the track geometry and overall quality of work is deemed acceptable by SEPTA Track Engineering based on the approved set of plans.

B. Prior to final acceptance and concrete pours, rail strings installed and anchored outside of the specified rail neutral stress temperature range shall be thermally adjusted and reanchored using the methods described in the SEPTA Railroad Division SMW-100 Part 3 - CWR Plan.

C. All tracks included in the work shall be free from construction debris and loose OTM (other track material) prior to final acceptance. Flange-ways shall be cleared of any loose debris. A general clean-up of trash shall be conducted through the job site before returning tracks to service and final acceptance of the Work.

PART 4 – MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02450
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SECTION 02454
TRACKWORK REMOVAL

PART 1 - GENERAL

1.01 DESCRIPTION
   A. This Section specifies the removal, disposal and selected salvage of existing track materials as required for the bridge replacement work and new installation of mainline tracks.

1.02 RELATED WORK
   A. Section 02450 – Trackwork – General.

PART 2 - PRODUCTS

2.01 RAIL RETURN JUMPERS
   A. Cable and connectors for rail return shall be in conformance with the requirements of the Train Detection and Wire Cable Sections of these Specifications.

PART 3 - EXECUTION

3.01 GENERAL
   A. Prior to the removal of any rail, traction power return jumpers shall be installed to provide a continuous path for traction power return current. The Contractor shall take necessary precautions to prevent a train from entering this work zone in accordance with the Subway Elevated Division Safety Requirements and Special Project Procedures of these Specifications.

3.02 TRACK REMOVAL
   A. Remove all existing track required for road, trolley track, and bridge work to project limits of total reconstruction, as described herein and as indicated on the Contract Drawings.

   B. Rail shall be cut square and clean by means of rail saws or abrasive cutting wheels in accordance with AREMA “Specifications for Steel Rails”. Torch cutting of rails is prohibited. Rail ends not within 1/32 inch of square shall be cut square. Each rail shall be cut at the required location at each end the bridge, with no intermediate cutting (single string to be removed for each rail across bridge).

   C. Remove rail, tie plates, fastener assemblies, ties and resilient rail fasteners in areas of total reconstruction. Rail and plates shall be stored in a manner that the items will not be damaged and may be reused by SEPTA. Existing ties, spikes, and fasteners shall be removed from the job site.
D. Use only tools designated for the proper activity, such as rail tongs to remove material to be salvaged.

E. Material which is to be salvaged that is damaged during removal shall be replaced with new materials of the same type, as approved by the Project Manager.

3.03 PROTECTION OF EXISTING FACILITIES

A. Protect all existing facilities not designated for removal including, but not limited to, signal and communications facilities, and traction power equipment. All damage caused by the Contractor's work shall be repaired to the satisfaction of the Project Manager.

3.04 DESIGNATION OF TRACK MATERIALS

A. Track materials shall be designated as either salvage or scrap by the Project Manager.

B. Cross-ties to be scrapped shall be marked by the Project Manager in accordance with the Railroad Trackwork Section of these Specifications.

C. Scrap ties, spikes, and fasteners where track is designated for rail replacement on the Contract Drawings.

D. Removal of environmentally harmful materials shall be done in accordance with state and federal procedures. The Contractor will identify the name and location of the disposal site and submit them to the Project Manager for review.

3.05 DISPOSAL OF SCRAP MATERIALS

A. The Contractor shall take possession and properly dispose of all scrap materials.

B. All scrap materials shall be removed from the project site as soon as possible and shall not be left to accumulate on SEPTA's right-of-way.

C. Ties shall be removed to Liberty Yard.

3.06 SALVAGE MATERIALS

A. Remove materials designated for salvage with equipment that will not damage the materials. Use only tools and equipment which are manufactured for the task, such as rail tongs for rail removal.

B. Transport all salvage materials that will not be immediately returned to use to a location designated by the Project Manager for salvaged material storage.

C. Inventory and mark all salvage items. Submit the inventory to the Project Manager. Mark salvaged items for reassembly prior to dismantlement.

D. Store salvaged material in a fashion that will prevent damage and allow for easy removal. Place wood blocks between rails. Store salvaged materials in a manner approved by the Project Manager.
PART 4 – MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02454
PART 1 - GENERAL

1.01 SUMMARY

A. The work of this Section includes technical requirements for the rail fastening system and its components to be used in the work shown on the Contract Documents.

B. Rail fasteners shall be generally in accordance with Volume 1, Chapter 5 of the AREMA Manual for Railway Engineering.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals.

B. Section 01400 – Quality Requirements.

C. Section 02450 – Trackwork – General.

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. Contractor shall submit the following:

1. Catalog cuts and manufacturer data for items listed herein.

2. Site Specific Work Plans.

1.05 QUALITY ASSURANCE

A. Quality Assurance Program: Contractor shall refer to Section 01400, “Quality Requirements” and conform to the requirement of the Quality Assurance Program.

PART 2 - PRODUCTS

2.01 DESIGN

A. For the rail plate system the rail fastening system shall be composed of:

1. Pandrol “e” Series Rail clips.
2. eClip Heavy Duty Insulator; Post Thickness 0.125” – used with rail boot to prevent any tearing of rubber boot.

B. For the Steel Support Tie the rail fastening system shall be composed of:
   1. Nylon reinforced plastic clips.
   2. Steel washers.
   3. SAE-Grade 5 or ASTM A449 bolts with hexagonal head and nut.

2.02 MATERIAL

A. Pandrol “e” type clips shall meet the requirements of AREMA Manual for Railway Engineering, Chapter 5, Part 9 - Design Qualifications for Elastic Fasteners.

B. Composite compression clip with bolts for steel ties as shown on plan sheet R002 with steel support tie.

C. Steel Support Tie components shall be in accordance with steel support tie manufacturer’s recommendations.

D. Nylon reinforced plastic clips.

E. Steel washers – ASTM F436.

F. SAE-Grade 5 or ASTM A449 bolts with hexagonal head and nut.

2.03 CLIPS, INSULATORS, WELD ON SHOULDERS

A. All rails shall be manually ultrasonic tested at rail ends in accordance with the current edition of the AREMA Manual for Railway Engineering, Vol. 1, Chapter 4, Part 2, Article 2.1.17.2.

PART 3 – EXECUTION

NOT USED

PART 4– MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02459
PART 1 - GENERAL

1.01 SUMMARY
A. The work of this Section includes technical requirements for steel running rail to be used in the work shown on the Contract Documents.
B. Steel rails shall be in accordance with Volume 1, Chapter 4 of the AREMA Manual for Railway Engineering for tee rails weighing 115 lb/yd and over.

1.02 RELATED SECTIONS
A. Section 01300 – Submittals.
B. Section 01400 – Quality Requirements.
C. Section 02450 – Trackwork – General.
D. Section 02468 – Rail Welding.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. Contractor shall submit the following:
   1. Certificates and Reports.
      a. Certificates of material compliance required by AREMA and this Specification.
      b. Test reports of chemical analyses, and other tests required by AREMA and the Contract Documents.

1.05 QUALITY ASSURANCE
A. Quality Assurance Program: Contractor shall refer to Section 01400, “Quality Requirements” and conform to the requirement of the Quality Assurance Program.
B. All rail shall be inspected in accordance with the current edition of the AREMA Manual for Railway Engineering Vol. 1, Chapter 4, Part 2 for rails 115 lbs/yd and over.

PART 2 - PRODUCTS

2.01 MATERIAL
A. All rails shall be provided new; relay rails are not acceptable.
B. All rails shall be AREMA grade standard strength control cooled.
C. Rail Section: 115 pound RE.
D. The standard length of rail shall not be less than 39’ prior to welding.
2.02 MANUFACTURE

A. All steel rails shall be new, and manufactured in accordance with the current edition of the AREMA Manual for Railway Engineering Vol. 1, Chapter 4, Part 2, supplemented as follows:

1. Certificates and Reports.

PART 3- EXECUTION

NOT USED

PART 4- MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02466
SECTION 02468
RAIL WELDING

PART 1 - GENERAL

1.01 SUMMARY

A. The work of this Section includes, but is not limited to, providing all labor, materials, tools, equipment, and incidentals necessary for on-site fabrication and/or in track welding of continuously welded rail, CWR, to be used in the work shown on the Contract Documents.

B. Welded strings shall generally be fabricated using the Electric-Flash Butt Welding process in accordance with AREMA Manual for Railway Engineering, Chapter 4, Section 3.10, General Specification for In-Track Welding Using Electric Flash Butt (EFB) Welding Equipment, and as specified herein.

C. Thermite welding is not permitted.

D. All welding procedures shall also adhere to SEPTA SMW 100 Track Department Welding Standards. In cases where these Specifications conflict with the SMW 100 the more restrictive shall apply.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals.
B. Section 01400 – Quality Requirements.
C. Section 02450 – Trackwork – General.
D. Section 02466 – Steel Rail.

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. Contractor shall submit the following:
   1. Proposed methods and equipment.
   2. Site Specific Work Plans. Record of Welds: Provide records of all welds giving pertinent details of the welds such as current values, travel time, and any other data pertinent to the welds. Provide group records for each rail string, and location. Furnish plans indicating installed location of each string. Mark each rail string at both ends of the string, with the string number. Submit records to the SEPTA Project Manager.

1.05 QUALITY ASSURANCE

A. Quality Assurance Program: Contractor shall refer to Section 01400, “Quality Requirements” and conform to the requirement of the Quality Assurance Program.
B. Testing:

1. Provide ultrasonic testing of all welds in accordance with ASTM E164 and E317, and American Society for Nondestructive Testing Recommended Practice No SN7-TC-1A.

2. Welds shall exhibit one hundred percent (100%) fusion.

PART 2- PRODUCTS

2.01 MATERIAL

A. Section 02466 – Steel Rails.

PART 3- EXECUTION

NOT USED

PART 4- MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02468
PART 1 - GENERAL

1.01 SUMMARY

A. The work of this Section includes technical requirements for the rail boot used in the work shown on the Contract Documents.

B. Rail Boot shall be generally in accordance with TCRP report, Track Design Handbook for Light Rail Transit Second Edition.

C. Rail Boot shall be generally in accordance with the AREMA Manual for Railway Engineering.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals.

B. Section 01400 – Quality Requirements.

C. Section 02450 – Trackwork – General.

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. Contractor shall submit the following:

   1. Catalog cuts and manufacturer data for items listed herein.
   2. Site Specific Work Plans.

1.05 QUALITY ASSURANCE

A. Quality Assurance Program: Contractor shall refer to Section 01400, “Quality Requirements” and conform to the requirement of the Quality Assurance Program.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Volume Resistivity

   1. Method: In accordance with ASTM D 257, at 50 percent relative humidity and 77 degrees F shall be measured for a dry specimen and then for the same specimen after 7 days immersion in a 3 percent NaCL solution. The specimen from the latter test shall be wiped dry prior to testing and no more than 1 hour shall elapse between removal from immersion and performing the test.
2. Acceptance Criterion: \(1 \times 10^{12}\) ohm-cm minimum.

**B. Surface Resistivity**

1. Test Method: In accordance with ASTM D 257.
2. Acceptance Criterion: \(1 \times 10^{12}\) ohm Min.

**C. Durometer Hardness Test**

1. Test Method: In accordance with ASTM D 2240, report for cured specimens and specimens aged 24 hours at 75 degrees F.

**D. Tensile Strength Test**

1. Test Method: In accordance with ASTM D 412.

**E. Tear Strength**

1. Test Method: In accordance with ASTM D624.
2. Acceptance Criterion: 150 lb/in Min.

**F. Ultimate Elongation**

1. Test Method: In accordance with ASTM D412.
2. Acceptance Criterion: 600% Min.

**G. Compression Set (22 hours at 158 degrees F)**

1. Test Method: In accordance with ASTM D395 Method B.
2. Acceptance Criterion: 35% Max.

**H. Ozone Resistance 70 hours at 100 degrees F, 20% elongation of T-50 specimen, 50 pphm air.**

1. Test Method: In accordance with ASTM D1149.
2. Acceptance Criterion: No cracks shall be apparent to the unaided eye after 168 hours.

**I. Absorption of Moisture**

1. Test Method: In accordance with ASTM D570.
2. Acceptance Criterion: 2% Max (percent water absorption by weight).

**J. Chemical Resistance**

1. Test Method: In accordance with ASTM D471, oil swell, IRM 903.
2. Acceptance Criterion: +70 percent by weight maximum.

**K. Puncture Test**

1. Test Method: In accordance with FTMS 101C – Method 2065.
2. Acceptance Criterion: Slow speed direct load at rupture should not be less than 60-lbs. force. Specimen should not be less than 1/8” thick.

**L. Dimensional Requirements**

1. Rail boot and cuff shall be preformed to fit 115#RE rail section.
2. Rail boot, support systems should be compatible to snugly fit the rail boot into the rail and hold line and gauge.
3. Recess dimension requirements from top of rail boot to top of rail when installed shall be as shown on the Standard Drawings.
4. Rail boot profile when embedded in concrete should be designed to have the compression and stiffness properties that will keep the track gauge within tolerance when the rail head is subjected to lateral forces from rubber tired vehicular traffic and/or from light rail vehicles wheels.

M. Adhesive sealant and rubberized mortar filler materials to be used between rail boot and cuff for joining boot ends shall be as recommended by the rail boot supplier and approved by the Resident Engineer.

N. Submit certification and project history report from the manufacturer that the installed product has been installed in an urban environment for a minimum of 10 years with no failure.

O. An acceptable rubber boot and cuff extrusion system for setting and encapsulating the rail shall be supplied by:
   1. Iron Horse Engineering Company.
   2. An approved equal with ten-years history of proven performance.

PART 3- EXECUTION

NOT USED

PART 4- MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02470
SECTION 02472
STEEL SUPPORT TIE

PART 1 - GENERAL

1.01 SUMMARY

A. The work of this Section includes technical requirements for the Steel Support Tie and its components to be used in the work shown on the Contract Documents.

1.02 RELATED SECTIONS

A. Section 01300 – Submittals.
B. Section 01400 – Quality Requirements.
C. Section 02450 – Trackwork – General.

1.03 REFERENCE STANDARDS


1.04 SUBMITTALS

A. Contractor shall submit the following:
   1. Catalog cuts and manufacturer data for items listed herein.

1.05 QUALITY ASSURANCE

A. Quality Assurance Program: Contractor shall refer to Section 01400, “Quality Requirements” and conform to the requirement of the Quality Assurance Program.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Insulated support ties with fasteners shall be furnished complete for assembly of rail and rail boot.
B. Steel support tiles shall hold the rail in alignment during the concrete pour.
C. Steel Support ties shall be C-5x9 structural shape carbon steel per ASTM A36 and shall have a minimum width of 5” to support the rail. Tie rail seat area shall accommodate booted rail at a track gauge of 5’-2 1/4 inches. Rail shall be fastened with a composite compression clip. The composite compression clip shall consist of nylon reinforced plastic clips, steel washers and SAE-Grade 5 or ASTM A449 bolts with hexagonal head and nut.
PART 3 - EXECUTION

NOT USED

PART 4 - MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02472
SECTION 02474
RAIL PLATE AND GALVANIZED ANCHOR PLATE

PART 1 - GENERAL

1.01 SUMMARY
A. The work of this Section includes technical requirements for the rail plate and the galvanized anchor plate to be used in the work shown on the Contract Documents.

1.02 RELATED SECTIONS
A. Section 01300 – Submittals.
B. Section 01400 – Quality Requirements.
C. Section 02450 – Trackwork – General.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. Contractor shall submit the following:
   1. Catalog cuts and manufacturer data for items listed herein.
   2. Site Specific Work Plans.

1.05 QUALITY ASSURANCE
A. Quality Assurance Program: Contractor shall refer to Section 01400, “Quality Requirements” and conform to the requirement of the Quality Assurance Program.

PART 2- PRODUCTS

2.01 MATERIAL
A. The rail plate material shall conform to ASTM A-36 (ASSHTO M183) requirements, Standard Specification for Structural Steel for Bridges.
C. Galvanized anchor plate studs shall conform to ASTM A108-13, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished for 1010 through 1020 mild steels.
E. Headed anchor bolts shall be ASTM A307, Grade A, with supplemental S1 requirements.
PART 3- EXECUTION

NOT USED

PART 4- MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02474
PART 1 - GENERAL

1.01 SUMMARY
A. The work of this Section includes technical requirements for compromise rail joint assemblies to be used in the work shown on the Contract Documents.

1.02 RELATED SECTIONS
A. Section 01300 – Submittals.
B. Section 01400 – Quality Requirements.
C. Section 02450 – Trackwork – General.
D. Section 02466 – Steel Rail.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS
A. Contractor shall submit the following:
   1. Certificates and Reports.
      a. Certificates of material compliance required by AREMA and this Specification.
      b. Test reports of chemical analyses, and other tests required by AREMA and the Contract Documents.

1.05 QUALITY ASSURANCE
A. Quality Assurance Program: Contractor shall refer to Section 01400, “Quality Requirements” and conform to the requirement of the Quality Assurance Program.
B. New compromise rail joint assemblies are to be furnished; they shall meet the material requirements of the Specification entitled: Specification for High Carbon Steel Joint Bars, AREMA Manual - Current Edition.

PART 2 - PRODUCTS

2.01 MATERIAL
A. Compromise Joint Bars shall be new as indicated in the Contract Documents, and be of proper design for the rail sections to be connected.
B. Rail Sections: 115 # RE to 128# GR.
C. Bolts set shall be new, and of the proper design and size, for the two rail sections to be connected.


F. Compromise joint bar lubricant shall have a petroleum base and contain a rust inhibitor.

PART 3- EXECUTION

NOT USED

PART 4- MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02476
SECTION 02482
Catenary Pole

PART 1 - GENERAL

1.01 SUMMARY

A. The Work of this Section includes technical requirements for the catenary pole to be used in the work shown in the Contract Documents.

1.02 RELATED SECTIONS

A. Division 01 – General Requirements.

B. Section 01330 – Submittals.

C. Section 01400 – Quality Requirements.

D. Section 09900 – Paints and Coatings.

E. Section 02220 – Excavation, Backfill and Compaction.

F. Section 03300 – Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. The Following listed standards shall apply to the Work in this Section, excerpt as modified herein, and are made a part of the Specification to the extent required:

1. American Welding Society (AWS)
   a. AWS D1.1 – Structural Welding Code

   a. ASTM A36 – Standard Specification for Carbon Structural Steel
   c. ASTM A153 – Standard Specification for Zinc (Hot-Dip) on Iron and Steel Hardware
   d. ASTM A992 – Standard Specification for Structural Steel Shapes
   e. ASTM E709 – Standard Guide for Magnetic Particle Testing
   g. ASTM A370 – Standard Test Methods and Definitions for Mechanical Testing of Steel Products
   a. MIL-P-21305 – Paint High Zinc Dust Content, Galvanizing Repair.

1.04 QUALITY ASSURANCE

A. Quality control activity shall be in accordance with Section 01400 Quality Requirements, except where varied herein.

B. Qualifications for Welding Work:
   1. Quality of welding processes and welding operations shall be in accordance with AWS D1.1.
   2. Provide certifications that welders employed have satisfactorily passed AWS qualification tests within the previous 6 months of the date when welding is performed.

C. Source Quality Control – Material and fabrication procedures are subject to the inspections and tests in the mill, shop and field. These inspections and tests shall not relieve the Contractor of the responsibility for providing materials and fabrication procedures that are in compliance with the requirements.

D. Material Testing – The chemical compositions and appropriate mechanical properties shall be determined for all materials used, either by obtaining manufacturer’s certificates of compliance or by laboratory testing at a facility which is acceptable to the Engineer.

E. Welding Testing:
   1. The services of an AWS Certified Welding Inspector shall be provided by the Fabricator to perform specified fabrication and verification inspection of welding procedures and personnel, and to perform weld tests as specified herein. Approval of the Welding Inspector shall be obtained from the Engineer.
   2. A visual inspection of all welds shall be performed in conformance with the AWS code.
   3. Weld testing shall be performed on selected at random by the Engineer.
   4. Equipment, procedures and personnel for weld testing, and test reports shall conform to the requirements of AWS D1.1, Section 6, Inspection.
   5. Weld testing shall consist of:
      a. Magnetic particle testing conforming to the requirements of ASTM E709.
   6. The pole selected for testing shall be tested by the magnetic particle method.
   7. If the tested pole is found to be unacceptable, weld testing shall be performed on a further pole selected at random by the Engineer.
   8. Results of weld testing shall be deemed acceptable or unacceptable in accordance with AWS D1.1, Sections 8, 9 or 10.
9. Welds found to be unacceptable shall be repaired as specified, and retested at the contractor’s expense.

F. Impact Testing – Structural steel materials for base plates and pole shafts shall be tested for impact toughness in accordance with the Charpy V-notch test as specified in ASTM A370. The minimum energy value shall be 15 foot-pounds at 0 degrees Fahrenheit.

1.05 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of Section 01300, Submittals, except as modified herein.

B. Items required to be submitted by the Contractor for approval include, but are not limited to, the following:

1. Specifications for welding procedures and processes, certificates of qualifications of welders, welding operators, tackers and welding inspections for acceptance, together with the installation instructions for all components in this Section.

2. Shop drawings of all pole types required. The shop drawings shall be drawn to scale giving complete information necessary for the fabrication of the poles. The drawings shall also indicate all fittings, holes and accessories, and shall also give location, sizes and types of all welds.

3. Prior to commencing fabrication, the manufacturer’s certificates of compliance or certified laboratory test reports. The reports shall demonstrate the compliance of all raw materials and fabrication products. Included shall be a listing of all standards designated by the manufacturer, as indicated.

4. Copies of test reports of all factory tests as required by these Specifications and reference standards.

1.06 DELIVERY, STORAGE, AND HANDLING

A. During fabrication and delivery, steel products shall be handled and transported in a manner that will prevent damage occurring to the structural steel, galvanizing and surface coating.

B. Material shall not be stored in contact with the ground. It shall be stored in a manner and location that will not cause deterioration of the material.

C. Any damage to the material and equipment shall be the Contractor’s responsibility and all repairs shall be made by the Contractor in accordance with the manufacturer’s instructions, at the Contractor’s expense.

PART 2- PRODUCTS

2.01 POLE MATERIALS

A. Pole shafts shall be fabricated from one structural steel material type conforming to the pertinent ASTM Specifications.
B. Wide Flange Pole, A992, Grade 50 Steel.

C. Pole shafts shall not be spliced.

D. Weld filler shall be selected in compliance with the welding procedures of AWS D1.1 and shall be capable of producing satisfactory design strength.

E. All steel shall be handled carefully to keep it clean, and it is to be treated with the care and concern that should be to any product whose finished surfaces are to remain as prepared in the shop. The steel shall be kept free and clean of all foreign matter that may affect the natural oxidation of the steel. The Contractor shall immediately remove any foreign matter found on the steel.

F. Hot-dip galvanizing shall be in accordance with ASTM A123 for fabricated pole assemblies and ASTM A153 for hardware.

G. Miscellaneous structural steel shall conform to ASTM A36.

2.02 POLE FABRICATION

A. General – Poles shall be fabricated to the dimensions indicated on the Contract Drawings.

B. Methods – Poles and baseplates shall be fabricated by methods conforming to AISC Specifications, except as specified herein.

C. Welding Procedures – Welding procedures, welders, welding operations and tackers shall conform to the provisions of AWS D1.1, Section 2, Design of Welded Connections; Section 3, Workmanship; Section 4, Techniques; and Sections 8, 9 or 10.

D. Weld Repair – Welds found to be unacceptable shall be repaired in accordance with the provisions of AWS D1.1, Section 3, Workmanship.

E. The connections shall be welded in accordance with the Contract Drawings and shall be fabricated in the shop using E70xx electrodes in compliance with the welding procedures of AWS D1.1.

1. Location of Holes - +1/16 inch each direction.

2.03 POLE COATINGS

A. Completed pole assemblies shall be hot-dip galvanized in accordance with ASTM A123.

2.04 POLE PAINTING

A. Selected poles shall be painted as shown in the Specification.

B. Painting shall be in accordance with Section 09900, Paints and Coatings
PART 3- EXECUTION

3.01 PREPARATION

3.02 ERECTION

A. Steel poles shall be installed on the foundations as shown on the Contract Drawings.
   1. Rake poles for aesthetic appearance after loading. The following values are suggested:
      a. Poles
         1) Side poles for pull off conditions – ¼ inch in 1 feet (1 in 48) away from adjacent pole.

B. After complete installation of the pole, the following information shall be recorded by the Contractor and submitted to the Engineer:
   1. Pole stationing and reference track.
   2. Pole assembly reference.
   3. Face of pole to track centerline dimension.
   4. Pole rake.

C. The

3.03 FIELD REPAIR OF ZINC COATED SURFACES

A. Where zinc coating has been damaged, clean substrate surface and repair with zinc dust-zinc oxide coating in accordance with MIL-P-21035.

B. Field repair zinc coated surfaces with:
   1. ZRC, as manufactured by ZRC Chemical Products Company.
   2. Galvicon, as manufactured by Galvicon Company.
   3. Or Engineer approved equal.

C. Apply zinc repair coating as recommended by the manufacturer.

D. Apply zinc repair coating in thickness 25% greater than the original coating.

E. Field repair painted surfaces. Where painted surfaces have been damaged, clean substrate surface and repair with paint in accordance with 09900, Paint and Coatings
PART 4—MEASUREMENT AND PAYMENT

NOT USED

END OF SECTION 02482
SECTION 02484
CATHODIC PROTECTION

PART 1 – GENERAL

1.01 SUMMARY OF WORK

A. The Work of this Section includes the technical requirements for the rail bonds to be furnished and delivered to the project by Contractor in accordance with the Contract Documents.

B. The Work of this Section also includes but is not limited to providing all supervision, labor, tools, equipment, materials, transportation and incidentals necessary to establish balanced current loading for the traction power rail return system via the rail bonds in the Work described in the Contract Documents, at the locations shown on the Contract Drawings and in accordance with the technical directives stipulated in this Section.

1.02 REFERENCE STANDARDS


1.03 SUBMITTALS

A. Contractor shall submit the following in accordance with the requirements of Section 01300 Submittals regarding cathodic protection materials and procedures proposed for use in the Work.

1. Product data: Catalog cuts, installation procedures, and other relevant manufacturer’s data for each component material item listed in this Section or otherwise used in the Work of this Section.

1.04 QUALITY ASSURANCE

A. Materials delivered to the project that fail to meet the requirements of this Specification shall be immediately quarantined from acceptable stockpiles, clearly identified as deficient, and promptly removed from the project, at no additional cost to SEPTA.
B. Field Quality Control.

1. Test each rail bond for mechanical integrity and electrical impedance immediately after installation of the bond and return of the materials to ambient temperature.

2. Impedance: Maximum 80 micro-ohms.

C. All costs and expenses for all quality assurance and quality control activities shall be borne by Contractor, at no additional cost to SEPTA.

PART 2 - PRODUCTS

2.01 RAIL CROSS BONDS

A. Rail Cross Bonds at locations shown on the Contract Drawings furnished by Contractor.

1. All rail web bonds shall be bolted, using hardware manufactured by Cembre Inc. or Erico Products Inc., or approved equal.

2. Description: Class B concentric-stranded conductor conforming to ASTM B8 with 2 kV EPR insulation.

   a. Contractor shall verify the required lengths of the manufactured joint bonds in the field prior to procurement.

3. Size: 1 x 500 MCM.

2.02 RAIL JOINT BONDS

A. Rail Joint Bonds for use at bolted rail joints in guarded curves furnished by Contractor.

1. All rail web bonds shall be bolted, using hardware manufactured by Cembre Inc. or Erico Products Inc., or approved equal.

2. Description: Class B concentric-stranded conductor conforming to ASTM B8 with 2 kV EPR insulation.

   a. Contractor shall verify the required lengths of the manufactured joint bonds in the field prior to procurement.

3. Size: 1 x 500 MCM.

B. Rail Bond Materials and Hardware furnished by Contractor.

1. Use only tool and material kits of the same make and manufacture as recommended by Manufacturer of the rail bonds, thus assuring a single source responsibility for the completed rail bonding products.
PART 3 – EXECUTION

3.01 INSTALLATION OF RAIL BONDS

A. Install all rail bonds in accordance with Manufacturer's recommended procedures.

B. At each bond location, for either rail cross bonds or rail joint bonds, install a single conductor with a size of 500 MCM.

C. In the case of multiple bond attachments at a single location, the attachment points of individual web bonds shall be no closer together than 4” C-C per AREMA recommendation measured longitudinally along the steel rail, including situations where two bonds are attached to opposite sides of the rail.

D. For rail cross bonds, all four running rails shall be daisy-chained together including across the roadway centerline, at approximately 250’ intervals.

E. The ends of joint bond and cross bond conductor cables and associated connection hardware shall be installed with no bare conductor materials exposed directly to concrete - elastomeric grout shall be used as necessary to completely cover any bare conductor materials.

3.02 CONDUITS

A. All rail cross bonds, including the bonds across the roadway centerline between the two center rails, shall be installed in conduit.

B. Conduits across the centerline of the roadway may be supported with concrete bricks in preparation for placing the roadway concrete.

C. Seal the openings of the conduit end bells and the cross bond conductors with duct sealant in accordance with the FRE conduit Manufacturer's guidelines.

D. Rail joint bonds across bolted rail joints in guarded curves can be direct buried in the concrete without conduits.

END OF SECTION 02484
SECTION 02530
BITUMINOUS CONCRETE PAVING

PART 1– GENERAL

1.01 DESCRIPTION
A. Furnishing and constructing pavement base courses and wearing courses of hot mixed asphalt concrete.
B. Milling and overlay of existing bituminous street pavement surfaces.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02230 – Subbase Course
D. Section 02235 – Subgrade
E. Section 02531 – Bituminous Tack Coat

1.03 SUBMITTALS
A. Submit the following in accordance with provisions of Section 01300:
   1. Furnish samples, manufacturer’s product data, test reports, materials’ certifications and mix design for Bituminous Concrete Pavement to show that it conforms to Specifications.

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS

2.01 MATERIALS
A. Bituminous Concrete Base Course: PennDOT Publication 408, Specifications, Section 305.2.
B. Bituminous Binder Course: Bituminous Binder Course, ID-2 conforming to PennDOT Publication 408, Specifications, Section 421.2.
C. Wearing Course: Bituminous Wearing Course, ID-2, conforming to PennDOT Publication 408, Specifications, Section 420.2.
D. Bituminous Material:
   1. Emulsified asphalt, class AE-T(tack coat), conforming to PennDOT Publication 408, Specifications, Section 460.2.
2. Bituminous prime coat, conforming to PennDOT Publication 408, Specifications, Section 461.2.

3. Subbase Course: Section 02230

PART 3– EXECUTION

3.01 BITUMINOUS CONCRETE STREET PAVEMENT

A. Existing street pavements milled, damaged or removed during construction of this project and street pavements over completed utility trenches and foundation excavations, shall be reconstructed as indicated in the Contract Drawings or as directed.

1. Bituminous Scratch and Leveling Course: Where indicated, place a separate scratch or leveling course ahead of resurfacing operations. Use a scratch course to fill wheel ruts and other local small depressions even with the surrounding pavement. Use a leveling course to provide a relatively uniform working platform for placing binder or wearing courses. The bituminous mixture is made of a fine aggregate due to the usually thin depth of scratch and leveling courses. In order to compact these thin, inconsistent layers, use a pneumatic roller.

2. Bituminous Concrete Base Course: Construct bituminous concrete base course in accordance with PennDOT Publication 408, Specifications, Section 309.3.

3. Bituminous Binder Course: Construct bituminous binder course in accordance with PennDOT Publication 408, Specifications, Section 431.3.

4. Bituminous Wearing Course: Construct bituminous wearing course in accordance with PennDOT Publication 408, Specifications, Section 430.3.

5. Bituminous Material: Place bituminous material in accordance with PennDOT Publication 408, Specifications, Sections 460.3 and 461.3.

6. Joint Sealant: AC-20, Place joint sealant in accordance with PennDOT Publication 408, Specifications, Section 469.

B. Milling and overlay work shall not commence until all work within the Right-of-Way is completed or as directed by Project Manager.

1. Milling: perform milling operations in accordance with PennDOT Publication 408, Specifications, Section 491.3.
SECTION 02531
BITUMINOUS TACK COAT

PART 1– GENERAL

1.01 DESCRIPTION
   A. This work is the conditioning and treating of an existing surface with an application of bituminous bonding material.

1.02 RELATED SECTIONS
   A. Contract Agreement
   B. Division 1 – General Requirements
   C. Section 02230 – Subbase Course
   D. Section 02235 – Subgrade
   E. Section 02530 – Bituminous Concrete Paving

1.03 SUBMITTALS
   A. Submit a certificate to the Project Manager indicating the asphalt residue content of the material being used.

1.04 QUALITY ASSURANCE
   A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
      1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
         a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS

2.01 MATERIALS
   A. Bituminous Material: Emulsified Asphalt, Class AE-T, conforming to PennDOT Publication 408, Specifications, Section 702.
   B. Fine Aggregate (For Blotting), conforming to PennDOT Publication 408, Specifications, Section 703.1.

PART 3– EXECUTION

3.01 CONSTRUCTION
   A. Preparation of Existing Surface:
      1. Before delivering bituminous mixtures, remove and dispose of loose and foreign material and excess joint sealer and crack filler from the surface of existing pavement or previously placed pavement courses. If necessary, use a broom.
2. Before overlaying existing surfaces, apply a tack coat.

3. Apply a tack coat to previously placed courses if the Project Manager determines a tack coat is necessary to ensure bonding between the two courses.

B. Application of Bituminous Material:

1. Use a distributor designed, equipped, calibrated, maintained, and operated to uniformly apply material on surfaces with varying widths and up to 15 feet wide. Provide a distributor capable of maintaining a uniform distributing pressure and controlling the application rate within a tolerance of 0.02 gallon per square yard. Provide a distributor equipped with a tachometer, pressure gauges, accurate volume-measuring devices or a calibrated tank, a thermometer for measuring temperatures of tank contents, a power-operated pump, and full circulation spray bars with lateral and vertical adjustments.

2. The Contractor may use hand-spraying equipment in areas inaccessible to the distributor.

3. Determine the distributor’s application rate in the field according to PTM No. 747.

4. Apply emulsified asphalt tack coat, at a rate approved by the Project Manager, to leave a uniform asphalt residue from 0.02 gallon per square yard to 0.07 gallon per square yard on the treated surface, as directed. Obtain approval of the application rate. Apply the tack coat only when the air temperature is 40F and rising and when the existing surface is dry. Uniformly distribute the tack coat over the surface and as directed.

5. Uniformly distribute the tack coat at the junction of adjacent applications.

6. Correct all uncoated or lightly coated areas to the Project Manager’s satisfaction. At designated locations, correct areas with an excess of bituminous material by covering the area with sufficient dry fine aggregate to blot up or remove excess tack coat.

7. Allow the tack coat to cure, without being disturbed, until the Inspector-in-Charge determines the water has completely separated and evaporated.

C. Protection of Treated Surface:

1. Maintain and protect the treated surface against damage. Repair damaged areas to the Project Manager’s satisfaction before placing succeeding construction.

END OF SECTION 02531
SECTION 02533
CONCRETE SIDEWALK

PART 1– GENERAL

1.01 DESCRIPTION OF WORK
A. The work required under this section consists of furnishing all labor, materials, equipment, services and related items necessary to complete concrete sidewalk paving, and all related work. Complete, as indicated on the drawings or specified herein.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02235 – Subgrade
D. Section 03100 – Concrete Forms and Accessories
E. Section 03300 – Cast-in-Place Concrete

1.03 SUBMITTALS
A. Furnish samples, manufacturer's product data, test reports, materials' certifications, and as built drawings in accordance with submittals required under section 03300 “Cast-in-Place Concrete.”

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
   a. PennDOT Publication 408, Specifications
2. Comply with all applicable portions of the City of Philadelphia and Department of Streets standards and specifications.
3. Comply with applicable standards of the American Concrete Institute (ACI).

1.05 JOB CONDITIONS
A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2– PRODUCTS

2.01 MATERIALS
A. Concrete Materials
1. Comply with ACI 301 requirements for concrete mixtures.
2. Prepare design mixes, proportioned according to ACI 301, for normal-weight concrete determined by either laboratory trial mix or field test data bases, as indicated on the Drawings.
   a. Compressive Strength (28 days): 4,000 psi
b. Slump: 3 inches
   1) Slump Limit for Concrete Containing High-Range Water-Reducing Admixture: Not more than 8 inches after adding admixture to plant- or site-verified, 2- to 3-inch slump.
3. Add air-entraining admixture at manufacturer’s prescribed rate to result in concrete at point of placement having an air content of 6.0 percent within a tolerance of plus 1.0 or minus 1.5 percent.

B. Form Materials
   1. Shall meet the requirements specified in the latest edition of ACI.

C. Expansion Joints
   1. Shall meet the requirements specified in the latest edition of ACI.

D. Curing
   1. Membrane-forming curing and sealing compound or moist curing methods. Refer to Concrete Work in Section 03300.

PART 3– EXECUTION

3.01 SURFACE PREPARATION

A. Excavate, as required, and form the foundation at a depth 10 inches parallel with the finished surface of the sidewalk. If directed, remove unsuitable material as specified in PennDOT Publication 408, Specifications, Section 203.1(b). Thoroughly compact the foundation, finish to a firm, even surface; moisten if required.

B. On Crushed Stone Sub-base
   1. Remove loose material from compacted Crushed Stone Sub-base surface immediately before placing concrete.
   2. Proof-roll prepared Crushed Stone Sub-base surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.
   3. All subgrades under paving and other work of this section must be brought to maximum density before placement of any paving work or materials. Do not place any paving materials until all subgrades over which they are to be installed have been brought to satisfactory density.

3.02 FORM CONSTRUCTION

A. Set forms to required grades and lines, rapidly braced and secured. Install sufficient quantity of forms to allow continuous progress of work and so that forms can remain in place at least twenty-four (24) hours after concrete placement.

B. Check completed formwork for grade and alignment to the following tolerances:
   1. Top of forms not more than 1/8" in ten (10') feet.
   2. Vertical face on longitudinal axis, not more than 1/4" in ten (10') feet.

C. Clean forms after each use, and coat with form release agent as often as required to ensure separation from concrete without damage.

3.03 CONCRETE PLACEMENT

A. General
1. Comply with applicable requirements of Division 3 Sections for mixing and placing concrete.
2. Install appurtenances in accordance with manufacture’s specifications.

B. Do not place concrete until forms have been checked for line and grade. Moisten sub-base course if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete using methods which prevent segregation of mix.
D. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, or side forms. Use only square-faced shovels for hand spreading and consolidation.
E. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
F. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than one-half (1/2) hour, place a construction joint.
G. Place concrete 4 inches deep. Strike off, finish, and test, as specified in Section 03400, except that manual operations are allowed and a light broom finish applied.
H. Form outside edges and joints with a 1/4-inch radius-edging tool.
I. Form transverse dummy joints at 5-foot intervals, approximately 1/8 inch wide, and at least 1 inch deep.

3.04 JOINTS
A. General
Construct expansion, weakened-plane (contraction), and construction joints true-to-line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Weakened Plane (Contraction) Joints
Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth as shown on the drawings.
1. Toolled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finish edges with a jointer.

C. Construction Joints
1. Place construction joints at end of placements and at locations where placement operations are stopped for a period of more than one-half (1/2) hour, except when such placements terminate at expansion joints. Construct joints as shown or, if not shown, use standard metal keyway-section forms.

D. Expansion Joints
1. Provide expansion joints at locations including joints abutting concrete curbs, inlets, structures, and other fixed objects, unless otherwise indicated.
2. Place expansion joints at thirty (30') feet o.c. maximum in sidewalk areas.
3. Seal Joints
   a. Clean joints of all scale, dirt, curing compound, and other foreign material with a mechanized wire brush.
   b. Do not place poured joint-sealing material if the air temperature is less than 40F, unless allowed. Use heating equipment of an indirect heating type, constructed as a double boiler. Provide positive temperature control and mechanical agitation. Obtain the safe heating temperature and recommended pouring temperature from the manufacturer’s shipping container. Place the

WOODLAND AVENUE OVER MEDIA
ELWYN REGIONAL RAIL LINE
BRIDGE REPLACEMENT

Concrete Sidewalk
100% Submission 02533-3
material within this temperature range, but as close as possible to the recommended pouring temperature. Maintain a safe heating temperature. Maintain a single material batch at the pouring temperature for no more than 4 hours. Heat the material only once.

c. Fill the joint reservoir, created by the cleaning operation, with sealing material to a depth 1/8 inch below the top of sidewalk. Do not allow sealing material to spread over concrete surfaces.

3.05 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a ten (10') foot straightedge. Distribute concrete as required to relieve surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. After completion of floating and troweling when excess moisture or surface sheen has disappeared, complete surface finishing, with a light broom finish as shown on the drawings.

D. Do not remove forms for twenty-four (24) hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by the Construction Manager.

3.06 CURING

A. Protect and cure finished concrete paving, complying with applicable requirements of Division 03 Sections. Use membrane-forming curing and sealing compound or approved moist curing methods.

3.07 REMOVAL OF FORMS

A. Do not remove side forms until at least 12 hours after placing concrete. After removal of forms, fill minor honeycombed areas with mortar. As directed, remove and replace defective major honeycombed areas.

3.08 BACKFILLING

A. After the concrete has cured for at least 72 hours, backfill spaces adjacent to the sidewalk, using acceptable embankment material, as specified in PennDOT Publication 408, Specifications, Section 206.3(b)4.

B. Repair or replace existing pavement, curb, and sidewalk damaged due to construction. Satisfactorily dispose of unsuitable and surplus materials.

3.09 REPAIRS AND PROTECTIONS

A. Repair and replace broken or defective concrete, as directed by the Construction Manager, and where shown on the drawings.

B. Protect concrete from damage until acceptance of work. Exclude traffic from sidewalk for at least fourteen (14) days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

C. Sweep concrete pavement and wash free of stains, discoloration, dirt and other foreign material just prior to final inspection.
## TECHNICAL SUBMITTAL REQUIREMENTS
PORTLAND CEMENT CONCRETE SIDEWALK PAVING

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A = For Approval  I = For Information  S = Sample

END OF SECTION 02533
SECTION 02900
SEEDING AND MULCHING

PART 1– GENERAL

1.01 DESCRIPTION OF WORK
   A. This work includes furnishing all plants, labor, materials, and equipment to perform all operations required for the surface preparation, seeding, and fertilizing of all areas where natural vegetation has been disturbed or damaged by construction operations and on all newly constructed surfaces.

1.02 RELATED SECTIONS
   A. Contract Agreement
   B. Division 1 – General Requirements
   C. Section 02120 – Clearing and Grubbing
   D. Section 02220 – Excavation, Backfill, and Compaction
   E. Section 02270 – Soil Erosion and Sedimentation Control

1.03 SUBMITTALS
   A. Furnish certifications from the suppliers or manufacturers stating that all seeding materials meet the contract specifications.

1.04 QUALITY ASSURANCE
   A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
      1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
         a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS

2.01 MATERIALS
   A. Topsoil:
      PennDOT Publication 408, Specifications, Section 801 “Stockpiling Topsoil or Topsoil Mixture,” if on-site excavated material is used; and Section 802, “Topsoil Furnished and Placed,” if no suitable on-site material is available.
   B. Fertilizer:
      PennDOT Publication 408, Specifications, Section 804, “Seeding and Soil Supplements,” (10-20-20 formulation) delivered to work site in bags or other convenient containers, each fully labeled, conforming to the applicable state fertilizer laws and bearing the name, trade name or trademark of the producer.
      1. For the slope and embankments, seed mix shall be Formula D Level B seeding mixture as outlined in PennDOT Publication 408, Specifications, Section 804.2, Table A.
2. Seed that is wet, moldy, or otherwise damaged in transit or storage is not acceptable.
3. Seed shall be furnished in standard sealed containers unless prior written exemption is granted.

C. Mulch:
   PennDOT Publication 408, Specifications, Section 805 "Mulching". Mulch blankets as specified in Section 02270.

D. Water:
   PennDOT Publication 408, Specifications, Section 801 "Stockpiling Topsoil or Topsoil Mixture," if on-site excavated material is used; and Section 802, “Topsoil Furnished and Placed,” if no suitable on-site material is available.

PART 3– EXECUTION

3.01 SURFACE PREPARATION
   A. Grade all surfaces to be seeded as shown on the drawings.
   B. Prepare the sub-grade and place topsoil as required and in accordance with PennDOT Publication 408, Specifications, Section 803, “Placing Stockpiled Topsoil or Topsoil Mixture,” if on-site excavated material is used; and Section 802, “Topsoil Furnished and Placed,” if no suitable on-site excavated material is available.

3.02 APPLICATION
   A. PennDOT Publication 408, Specifications, Section 800, unless otherwise directed by the Engineer.
   B. Spread seed between March 1st and June 1st or between August 1st and October 1st unless otherwise directed by the Engineer. No herbicide usage is required.

3.03 CARE AND PROTECTION
   A. The Contractor shall be responsible for proper care and protection of the seeded areas during the construction period and for a period of one month following application of the seeding materials.
   B. Water if the ground becomes excessively dry.
   C. Seeded areas showing less than 85% coverage after one month are to be reseeded.
   D. Washouts or eroded areas are to be immediately restored and reseeded after such occurrences, at no cost to SEPTA.

3.04 FIELD QUALITY CONTROL
   A. Record all sources, trade names, and the quantity of each material and submit to the Engineer.

END OF SECTION 02900
SECTION 02910
STRUCTURE FOUNDATION DRAIN

PART 1 – GENERAL

1.01 DESCRIPTION
A. This work is furnishing and installing of the structure foundation drain and drain outlets, of the type and size indicated. This work also includes furnishing and placing No. 57 coarse aggregate wrapped in geotextile, Class 1.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 - General Requirements
C. Section 02220 – Excavation, Backfill and Compaction
D. Section 02280 – Geotextiles

1.03 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS

2.01 PIPES- PENNDOT PUBLICATION 408, SPECIFICATIONS SECTION 601.2(A)1 AND AS FOLLOWS:
A. General.
   1. Type: Use the type indicated. If not indicated, use any one of the types listed below.
   2. Size: Use pipe with a minimum inside diameter of 6 inches.
   3. Perforations: Perforate a pipe to provide a minimum water inlet area of 1.4 square inches per linear foot of pipe and, unless otherwise specified, as follows:
      a. Cut perforations cleanly so as not to restrict the flow of water.
      b. Provide either circular or slotted perforations, except do not use slotted perforations in smooth walled pipe.
      c. For circular perforations, provide holes with a nominal diameter not less than 3/16 inch or greater than 3/8 inch. Also, provide similar rows of perforations on both sides of the pipe's vertical centerline, with the lower most rows separated by an arc of 60 degrees minimum.
      d. For slotted perforations, provide slots not exceeding 1/8 inch wide and a length not more than 10% of the average inside circumference for 4-inch to 8-inch diameter pipe and not exceeding 2 1/2 inches for pipes larger than 8
inches. Additionally, center the slots in the corrugation valleys and at maximum 120 degree intervals about the pipe circumference.

4. Strength Test: As specified, except for plastic pipe test using the parallel plate load test, according to ASTM D 2412.

5. Infiltration Rate: For perforated or porous pipe, provide a minimum infiltration rate of 10 (gallons per minute) per linear feet of pipe, as determined according to AASHTO M 176M.

6. Pipe Length: Flexible plastic pipe, 6 inches in diameter, may be supplied in specified coiled lengths or standard increments agreeable to the Department. The use of long coils, 3,000 feet to 4,000 feet in length, is allowed, provided placement is by equipment recommended by the manufacturer and the pipe is not stretched or damaged during handling or placement. Furnish flexible plastic pipe, larger than 6 inches in diameter, and all sizes of rigid pipe in maximum lengths of 20 feet. Furnish lengths not less than 99% of the stated quantity. Measure with any suitable device accurate to 1/4 inch in 10 feet (0.2%) while the pipe is stress-free and at rest on a flat surface in a straight line.

7. Plastic Pipe: Furnish extruded or molded plastic pipe made of high density, flexible plastic. Furnish pipe that is permanently marked, stenciled, or labeled with manufacturer's name, pipe trade name, or type, average size the specification designates, the plant designation code, and the date of manufacture all at intervals of no more than 10 feet.

B. Corrugated Polyethylene (PE) Pipe: AASHTO M 252 modified as follows:
   1. SEPTA will determine the lot size for acceptance.
   2. Minimum pipe stiffness to be 30 pounds per square inch at 10% deflection, when tested according to ASTM D 2412.

C. Polyvinyl Chloride (PVC) Pipe: ASTM D 3034, ASTM F 758, Type PS46 or ASTM F 949 modified as follows:
   1. Minimum pipe stiffness 35 pounds per square inch at 5% deflection, when tested according to ASTM D 2412.
   2. Capable of being flattened to 40% of the original pipe O.D. without splitting, cracking, or breaking.

D. Acrylonitrile-Butadiene Styrene (ABS) Pipe: ASTM D 2751, modified as follows:
   1. Minimum pipe stiffness 35 pounds per square inch at 5% deflection, when tested according to ASTM D 2412.
   2. Capable of being flattened to 60% of the original pipe O.D. without splitting, cracking, or breaking.

E. Prefabricated Foundation Drains:
   1. General- Use prefabricated foundation drains consisting of an inert, plastic core, designed to carry water flow, wrapped in geotextile fabric for filtering purposes. Select from a manufacturer listed in Bulletin 15.
   2. Core Materials- An inert, plastic material resistant to commonly encountered chemicals and substances, having the following properties:
      a. Tensile strength, ASTM D 638 - 1,200 pounds per square inch, minimum
      b. Water absorption, ASTM D 570—0.01% after 24 hours
      c. Fungus resistance, ASTM G 21—no growth
d. Crush strength, Geosynthetic Research Institute, Drexel University, GRI-GC4—40 pounds per square inch, minimum

e. Flow rate, ASTM D 4716—15 gallons per minute feet minimum

f. Provide a minimum of 6% open core area on the pavement side face of the base drain and a minimum of 3% on the shoulder side face.

g. Provide unobstructed inflow through a minimum of 50% of the geotextile area on the pavement side face of the base drain and 12% of the geotextile area on the shoulder side face, when stretched across the face of the core.

3. Geotextile Fabric: Provide Class 1 geotextile, except slit film and heat bonded materials, conforming to the requirements of PennDOT Publication 408, Specifications, Section 735, modified as follows:

a. Apparent Opening Size (AOS), ASTM D 4751—U. S. Standard Sieve No. 70, minimum

b. Permeability, k, ASTM D 4491—0.001 cm/sec, minimum

c. Resins are to be virgin materials, unless otherwise approved, and identified as such in the certification statement.

4. Approval: Approval will be based on certified test data submitted by the manufacturer or testing by MTD, or both, before being listed in Bulletin 15.

5. Certification and Shipment to Project: Certify each shipment as specified in PennDOT Publication 408, Specifications, Section 106.03(b)3. Clearly identify each roll of pavement base drain by affixing a tag or sticker containing the following information:

a. Lot number

b. Manufacturer's name and address

c. Product type and designation

d. Product identification including thickness, height, roll length, and roll mass (weight)

e. Geotextile type and designation

6. Wrapping of the Core: Wrap the geotextile completely around the drainage core with the seam along the length of the drain, on the shoulder side face, and preferably near the midpoint. Fabricate the seam using a non water-soluble adhesive, if adhesive is used. Firmly attach geotextile to the protrusions on the pavement side face of the drainage core and spot-bond on the shoulder side face, or submit results of flow tests on the drain under loading with the geotextile unattached, to ensure that the geotextile will not deform under continuous loading to the point where flow capacity is diminished and the specified minimum flow rate is not achieved.

7. Splice Connections and Fittings: Provide standard fittings and splice connections along the pavement base drain, as indicated or as directed, of sufficient strength to withstand construction handling and permanent loading. Obtain approval for any nonstandard fittings and connections.

8. Outlets: PennDOT Publication 408, Specifications, Section 615.2

2.02 AGGREGATES.

A. Coarse Aggregate: Use No. 57 Coarse Aggregate as specified in PennDOT Publication 408, Specifications, Section 703.2
PART 3– EXECUTION

3.01 CONSTRUCTION

As shown on the PennDOT Standard Drawings and as follows:

A. Pipe, Trench, and Backfill
   1. Place foundation drain after fine grading is completed.
   2. Lay the pipe and make the joints according to the manufacturer’s recommendations.
   3. For perforated pipe, place the perforations down, unless otherwise directed.
   4. Seal the upgrade end of foundation drain to prevent entry of foreign material.
   5. Place No. 57 Course Aggregate around the foundation drain after having the pipe inspected by the Inspector-in-Charge.

B. Geotextiles, Class 1. Use Class 1 geotextile, as specified in PennDOT Publication 408, Specifications, Section 212.3(b), for all foundation drain construction.

C. Prefabricated Foundation Drains
   1. General. At least 2 weeks before beginning installation, submit the proposed installation method to SEPTA, in writing, and note any deviation from the plans or from the manufacturer's approved drawings. Upon request by SEPTA, have a technical representative from the manufacturer present during installation.
   2. Shipping and Storage. Ship drainage materials with protective covering and store in a manner so as not to damage or contaminate them. Visually inspect all materials, before placement, to ensure they are free from damage. Damaged drainage material will not be accepted. Store drainage material on an elevated platform and protect from weather and ultraviolet exposure. Do not remove material from the manufacturer's protective covering until ready to be installed. If material is rerolled and stored, use an approved protective covering equivalent to the manufacturer's original wrapping.
   3. Placement. Place prefabricated foundation drain as indicated and as shown on the Standard Drawings. Repair any tears in the geotextile according to the manufacturer’s recommendation.
   4. Connections, Fittings, and Outlets. Fit splice connectors into the drainage core so that they do not restrict flow. Follow the manufacturer's approved connection details. Do not allow backfill material to enter the connector at any point. For drainage cores that splice using male-to-female overlapping, roll back the geotextile onto the in-place drainage core, make the splice, and rewrap the geotextile over the completed joint. Provide a minimum of 6 inches of geotextile overlap from one section to the next.
   a. Install foundation drain outlet pipe and fittings as specified in PennDOT Publication 408, Specifications, Section 615.3, to establish positive drainage. SEPTA may restrict installation of additional sections of base drain until acceptable outlet installations are completed. Ensure transitions are smooth and nonrestricting to flow. Do not use “home-made” connections.
b. Install all fittings and connections to preclude soil intrusion into the drainage core or outlet piping and to provide continuity of drainage flow. Install fittings for positive, gravity flow, and outlet the drainage system as indicated or as directed. Protect all joints and fittings from damage during construction.

END OF SECTION 02910
SECTION 03100
CONCRETE FORM AND ACCESSORIES

PART 1– GENERAL

1.01 DESCRIPTION
A. The work specified in this Section consists of all labor, materials, equipment and services necessary to design, furnish materials for, fabricate, erect, and remove formwork, falsework and shoring for cast-in-place concrete, including a formliner system for the concrete bridge barrier and concrete barrier on wingwalls, indicated on the Contract Drawings, as specified herein and as needed for a complete installation.

B. In addition to the basic elements of formwork, the work includes the furnishing and installation of joints, sleeves, openings and embedded items into formwork as specified herein.

C. This Section includes, but is not limited to, the following items comprising the formliner system:
   1. Lumber Forms
   2. Plywood Forms
   3. Steel Forms
   4. Form Ties
   5. Chamfer Strips
   6. Inserts
   7. Form Release Agent
   8. Form Caulking
   9. Shop Fabricated Forms

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02530 – Concrete Sidewalk
D. Section 03200 – Concrete Reinforcement
E. Section 03300 – Cast-in-Place Concrete
F. Section 03700 – Reinforced or Plain Cement Concrete Pavements

1.03 SUBMITTALS
A. Submit the following in accordance with Section 01300:
   1. Manufacturer’s product data and installation instructions for form ties, form release agent, formliner system, dovetail anchor slots and form caulking.
   2. Manufacturer’s storage and handling requirements and recommendations for the formliner system.
   3. Manufacturer’s cleaning and maintenance instructions for the formliner system.
   4. For formliner panel specified, Spec Formliner Pattern No 1609, submit two (2) samples, minimum size of one (1) square foot, maximum size two (2) square feet, to SEPTA for review and approval.
5. Certification by a licensed Professional Engineer currently registered in the Commonwealth of Pennsylvania that structural designs for all field-constructed and prefabricated formwork to be used on this project, including shoring and re-shoring procedures for horizontal members and falsework, were prepared in accordance with applicable codes, standards and publications of the American Concrete Institute as referenced herein. Submission of the Contractor’s detailed Shop and Working Drawings of proposed formwork systems is not required and will not be reviewed for approval.

6. Form Removal Schedule: Submit proposed schedule for form removal indicating minimum length of time for form removal proposed for each type of element.

7. Obtain submittal reviews before delivery of materials to the project site.

**1.04 QUALITY ASSURANCE**

A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.

1. **American Concrete Institute (ACI):**
   a. ACI 301, Specifications for Structural Concrete.
   b. ACI 347R, Guide to Formwork for Concrete.
   c. ACI SP-4, Formwork for Concrete.

2. **American Plywood Association (APA):**
   a. APA Grade - Trademarks.

3. **American Society for Testing and Materials (ASTM):**
   b. ASTM A992, Steel for Structural Shapes for Use in Building Framing.
   c. ASTM C39, Compressive Strength of Cylindrical Concrete Cylinders.

4. **U.S. Department of Commerce Product Standards:**
   a. PS-1-74 for Construction and Industrial Plywood.

5. **Western Wood Products Association (WWPA):**


**1.05 DESIGN REQUIREMENTS**

A. Assume sole responsibility for the engineering, design, fabrication and installation of concrete formwork. Design formwork to produce concrete members identical in shape, lines and dimensions to members shown on the Contract Drawings.

B. Design of formwork including layout, spans, fastenings, joints, framed openings, and shoring systems shall be performed under the direct supervision of a licensed Professional Engineer currently registered in the Commonwealth of Pennsylvania, retained by the Contractor and experienced in structural design of formwork, falsework and shoring for cast-in-place concrete.

C. Design formwork to resist the loads and lateral pressures prescribed in ACI 347R and wind loads as specified by the International Building Code.
D. Design formwork bulkheads at construction joints to accommodate protrusion of reinforcing steel dowels as detailed on the Contractor’s Shop or Working Drawings prepared in conjunction with Section 03200.

E. Formwork surface materials: Use form surface material that will produce surfaces conforming to the following and as required to obtain the indicated finishes:
   1. Concrete exposed to view: Use material that will produce smooth, uniform, blemish-free concrete surfaces.
   2. Concrete concealed from view: Use material that will produce concrete surfaces free of fins and honeycombs.

F. Special Sections: Provide openings, offsets, keyways, recesses, moldings, chamfers, blocking, screeds, bulkheads, anchorages, inserts, and other features as required.

G. Design formwork to be readily removable without impact, shock, or damage to “green” concrete surfaces and adjacent materials.

H. Maintain the minimum concrete cover over the reinforcement with the minimum cover thickness measured at the lowest point of the pattern relief.

I. Exterior and interior faces of concrete bridge barrier and concrete barrier on wingwalls shall be constructed with the formliner.

J. Assume responsibility for errors of detailing and fabrication and the correct fit of the formwork.

K. Work of this Section shall be coordinated with the work of other trades so that construction is not delayed.

L. Allowable Tolerances:
   1. Set and maintain concrete forms within tolerance limits stated in ACI 347R. Provide more restrictive tolerances where required to meet project conditions.
   2. Formwork at exposed surface conditions, including slabs, beams, and walls shall not deviate more than 1/2" from theoretical design locations. Pile caps and grade beams shall not deviate more than 1" from theoretical design locations.
   3. Tolerances shall not be cumulative.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store form panels at least 2 inches above ground and maintain the panels well ventilated, dry and protected against damage or contamination that will affect the concrete. Support forms against warping.

B. Lift form panels by means that will protect them against damage and destruction. Support panels using strong backs while lifting panels in a horizontal position.

C. Deliver manufactured products in manufacturer’s original packaging with identification marks intact

1.07 PROJECT CONDITIONS

A. After stake layout of on-site conditions, verify locations of on-site elements with the Project Manager and revise layout of formwork drawings as necessary to reflect adjustments and actual conditions.

B. Protect formwork materials before, during and after erection to ensure acceptable finished concrete work. Protect in-place materials and other operations of work in connection with concrete placements.

C. In the event of damage to erected forms, make necessary repairs or replacements prior to concrete placements at no expense to SEPTA.
D. Allow sufficient times, as determined by the Project Manager from the approved schedule, between erection of forms and placing of concrete for the various trades to properly install their work.

E. Do not apply external or superimposed loads, lateral or vertical, until concrete has developed the specified 28-day compressive strength and a minimum age of 14 days.

F. Stay-in-place forms are not permitted without the Project Manager’s prior approval.

G. Field Measurements:
   1. Prior to commencement of the work, field verify existing dimensions, elevations, locations and conditions applicable to the work. Report variances and discrepancies from the Contract Drawings and potential interferences promptly to the Project Manager.
   2. Take sufficient field measurements prior to preparation of Shop Drawings and fabrication of construction materials, where possible, to ensure proper fitting of the work. However, do not delay job progress. Allow for adjustments and fitting wherever the taking of field measurements before fabrication may not be possible or might delay the work.
   3. Actual field-verified conditions may require modifications to the construction details indicated on the Contract Drawings. Perform the work to meet actual field conditions encountered.

PART 2– PRODUCTS

2.01 MATERIALS

A. Lumber Forms
   1. Use only stress-grade lumber. Form framing, sheathing and shoring shall conform to WWPA Catalog A.
   2. For lumber in contact with concrete, use lumber dressed on at least the side contacting the concrete with dressed or tongue-and groove edges.
   3. Other lumber may be dressed or rough.
   4. Do not use lumber formwork where a smooth form finish is required; use plywood or steel forms.

B. Plywood Forms
   1. Use only grade-marked plywood.
   2. Use B-B Plyform, Exterior Class 1 or 2, or HDO High Density concrete form plywood, Class 1 or 2 conforming to U.S. Product Standard PS-1.
   3. Use thickness as required to maintain alignment and surface smoothness, but not less than 3/4” thick.

C. Steel for Steel Forms
   1. Sheet: Use commercial grade not less than 22-gauge.
   2. Structural shapes: Use structural shapes that conform to ASTM A36/A36M.
   3. Maintain steel forms in rust-free condition by use of steel wool and light grinding, followed by coats of the specified release agent.

D. Steel Forms
   1. Use stock material for steel form surfaces that is free from warps, dents, bends, kinks, cracks, sags, and other irregularities.
   2. Thoroughly remove rust, oils and other foreign matter that could stain the concrete.
   3. Fabricate panels in conformance with the Contractor’s Shop or Working Drawings.
   4. Reinforce outward facing surfaces as required to prevent warping and deformation during concrete placement.
E. Formliner

1. Permitted thermoform formliners for concrete include:
   a. High Impact Polystyrene (HIPS): Single use only.
   b. Acrylonitrile butadiene styrene (ABS): Two (2) to four (4) uses permitted.

2. Formliner pattern is a recessed panel with 1-inch round stone finish, spec formliner pattern No. 1609. The rectangular form shape is 8'-2" L x 2'-2" H.

3. Final colors of Recessed Concrete Formlined Surface and the Concrete Pylasters (Columns) Federal Color Number #36373, in accordance with Section 09900.

4. Acceptable Manufacturers:
   a. Spec Formliners, Inc.
      1038 E. 4th Street
      Santa Ana, CA 92701
      Phone: 714-429-9500
      Fax: 714-429-1460
      Website: www.specformliners.com
   
   b. Or approved equal

5. Manufacturer Qualifications: Supplier of the formliners must have at least five (5) years of experience in delivering a complete system to the industry consisting of formliners, technical support, and on-site assistance.

6. See formliner catalogue cut at end of specification.

2.02 FORM ACCESSORIES

A. Form Ties

1. Provide a non-corrosive, non-staining, cone-type, snap-in concrete form tie suitable for the intended use providing an allowable working load as required.

2. Provide a form tie system that does not leave mild reinforcing steel after break-off or removal closer than 2 inches from the exposed surface. Do not use wire alone. Form ties and accessories shall not reduce the effective cover of the reinforcement.

3. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
   a. A-2 Cone Snap-in Form Tie; Dayton Superior Concrete Accessories, Dayton, OH.
   b. Plastic Cone Snap Ties; Award Metals, Baldwin Park, CA.
   c. Plastic Cone Snap Tie; Form Tech Concrete Forms, Inc., Wixom, MI.
   d. Or approved equal.

B. Chamfer Strips: Provide 1 inch by 1 inch triangular fillets all of which shall be milled from clear, straight-grain pine, surfaced each side, or all of which shall be extruded vinyl type with or without nailing flange unless otherwise indicated.

C. Inserts: Provide galvanized cast steel or galvanized welded steel inserts, complete with anchors to concrete and fittings such as bolts, wedges and straps.

D. Form Caulking: Provide a one-component, gun-grade silicone sealant that is capable of producing flush, watertight and non-absorbent surfaces and joints. Use sealant that is compatible with the type of forming material and concrete ingredients used.

1. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
   a. Series 1200 Construction Caulking; GE Silicones, Waterford, NY.
   b. Dow Corning 999-A; Dow Corning Co., Midland, MI.
c. Preco Silicone Caulk; Preco Industries, Ltd., Plainview, NY.
d. Or approved equal.

E. Form Release Agent: Provide a VOC compliant commercial formulation form-coating compound that will not bind with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede wetting of surfaces to be cured with water or curing compounds. Use a form release agent for the formliner that is recommended by the formliner manufacturer.
1. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
   a. Aquaform; Tamms Industries, Mentor, OH.
   b. Debond Form Coating; L&M Construction Chemicals, Inc., Omaha, NE.
   c. Eucoslip VOX; Euclid Chemical Co., Cleveland, OH.
   d. Or approved equal.

F. Non-shrink Grout: Patch form tie holes with non-shrink grout as specified in Section 03300.

G. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

2.03 SHOP FABRICATED FORMS

A. Fabricate forms in accordance with the Contractor’s Shop or Working Drawings.
B. Maintain forms clean, smooth, and free from imperfections and warping.
C. Formwork Joints: Locate as indicated on the Contractor’s Shop or Working Drawings. Note that horizontal construction joints in cast-in-place concrete shall be installed at locations shown on the Contract Drawings unless prior approval to deviate from those locations is obtained from the Project Manager.
D. Arrange form panels in symmetrical patterns conforming to the general lines of the structure.
E. Except when otherwise indicated, orient panels on vertical surfaces with the long dimension horizontal and with horizontal joints level and continuous.
F. Precisely align form panels on each side of the panel joint by means of fasteners common to both panels, to result in a continuous, unbroken concrete placement surface.
G. Use largest stock size practicable.
H. Between form joints, line an area less than the stock size of the form panel material with a single piece of panel material.

PART 3– EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section is to be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.
B. Prior to placement of concrete, inspect forms for cleanliness and accuracy of alignment.

3.02 ERECTION AND INSTALLATION

A. Construct forms in accordance with ACI 301 and 347R to required dimensions, plumb, straight and mortar tight, and make all joints and seams mortar-tight. Securely brace and shore forms to prevent displacement and to safely support imposed concrete load.
B. Erect beam and girder soffits in accordance with the provisions of ACI 347R and to the standard tolerances delineated therein. Soffits shall be sufficiently braced, shored, and wedged to prevent deflection.

C. Chamfer above grade exposed joints, edges and external corners of concrete forms with a 1-inch by 1-inch triangular fillet unless otherwise indicated.

D. Furnish forms for repeated use in sufficient number to ensure the required rate of progress. Clean forms and inspect immediately prior to depositing concrete. Remove deformed, broken or defective forms from the work site.

E. Provide temporary openings where interior area of formwork is inaccessible for cleanout, or inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent the loss of concrete mortar. Locate temporary openings on forms in as inconspicuous locations as possible consistent with the requirements of the work.

F. Provide openings in concrete formwork of the correct size and in the proper location to accommodate other operations of construction work in the project. Accurately place and securely support items to be built into forms. Install waterstops where shown on the Contract Drawings and as specified in Section 03300.

G. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface.

H. Provide required finish on formed concrete surfaces for cast-in-place concrete in accordance with Section 03300 and as indicated on the Contract Drawings.

I. Wet forms sufficiently to prevent joints in wood forms from opening prior to concrete pour.

J. Cutting form ties back from the face of the concrete is prohibited.

K. Formliners - Install in accordance with manufacturer's instructions.

L. Rustications
   1. Install reveal rustication strips in strict accordance with the manufacturer's written instructions and recommendations. Plug ends of form pattern and taped all form joints and edges using 1/8-inch thick by 3/4-inch wide foam tape centered on the joints, then caulked in accordance with the manufacturer's recommendations each time that forms are set.
   2. Forms for smooth concrete shall be installed in such a manner that there will be no horizontal form joints, and the forms shall be aligned so that vertical joints occur only at "V-Groove" rustications. Form ties shall be spaced in a uniform pattern vertically and horizontally. Form ties shall be positioned in smooth concrete bands and in panels between "reveal" rustications, if any.

M. Form Release Agents
   1. Apply form release agents in accordance with manufacturer's instructions and as specified herein:
      a. Coat form contact surfaces with form release agent compound before reinforcement is placed. Do not allow excess form release agent material to accumulate in the forms or to come into contact with surfaces that need to bond with fresh concrete, such as concrete reinforcement and embedded items.
      b. Before concrete placement, coat the contact surfaces of forms with a non-staining mineral oil, non-staining form coating compound, or two coats of nitrocellulose lacquer. Do not use mineral oil on forms for surfaces to which adhesive, paint, or other finish material is to be applied.
      c. Coat steel forms with non-staining, rust-preventive form oil or otherwise protect against rusting. Do not use rust-stained steel surfaces for contact with concrete.
d. Do not allow form coatings to come in contact with construction joints or reinforcing steel.

N. Observe formwork continuously while concrete is being placed to see that there are no deviations from desired elevation, alignment, plumbness and camber. If, during casting, weakness develops and the formwork shows settlement, deflection or distortion, stop the work, remove improperly cast concrete, and reconstruct the formwork to perform properly.

O. Apply form release agents in accordance with manufacturer's instructions and as specified herein:
   1. Coat form contact surfaces with form release agent compound before reinforcement is placed. Do not allow excess form release agent material to accumulate in the forms or to come into contact with surfaces that need to bond with fresh concrete, such as concrete reinforcement and embedded items.
   2. Coat steel forms with non-staining, rust-preventive form oil or otherwise protect against rusting. Do not use rust-stained steel surfaces for contact with concrete.

P. Do not allow excess form coating material to accumulate in the forms.

3.03 INSTALLATION TOLERANCES
A. Allowable Tolerances: Set and maintain concrete forms within the tolerance limits stated in ACI 347R

3.04 PROTECTION
A. During installation, do not use forms as a storage platform nor as a working platform until the forms have been permanently fastened in position.

B. Do not overload the surface of installed forms.

3.05 FIELD QUALITY CONTROL
A. Form and Form Tie Removal
   1. Remove forms in accordance with ACI 347R recommendations without damage to concrete and in a manner to insure complete safety to the structure and the public. Forms, form ties and bracing shall not be removed without specific permission of the Contractor's licensed Professional Engineer registered in the Commonwealth of Pennsylvania.
   2. Do not remove forms until the concrete has hardened sufficiently to safely support its own load, plus any superimposed load that might be placed thereon. Forms shall remain in place for the minimum time periods specified in ACI 347R, except that forms may be removed earlier than specified if ASTM C39 test results of field-cured concrete cylinder samples from a representative portion of the structure or other approved and calibrated non-destructive testing techniques show that the concrete has reached a minimum of 85 percent of the specified design strength.
   3. Remove top forms on sloping surfaces of concrete as soon as removal operations will not allow the concrete to sag. Perform needed repairs or treatment required on sloping surfaces at once followed immediately with the specified curing.
   4. Whenever formwork is removed during the specified curing period, continue curing the exposed concrete surfaces in accordance with one of the methods specified in Section 03300.
   5. Upon removal of forms, notify the Project Manager in order that a review of the newly stripped surfaces may be made before patching.
   6. Loosen wood forms for wall openings without causing damage to the concrete. Avoid prying against the face of finished concrete. Use only wooden wedges.
7. Take care in removing forms, wales, supports and form ties to avoid spalling or marring the concrete. Initiate rubbed finish, if required, and such patching as may be necessary immediately after removal.

8. Patch form tie holes with an approved non-shrink grout patching material in accordance with the manufacturer's recommendations.

9. Hammer-pack holes left by tie rods with stiff mortar of the same material as, but somewhat leaner than, that in the concrete. Render the patch inconspicuous. Complete patching within 24 hours of form removal.

B. Re-use of Forms

1. Forms for re-use shall meet new form requirements with respect to their effect on cast-in-place concrete appearance and structural stability.

2. Limit reuse of plywood to no more than three times. Re-use may be further limited by the Project Manager if it is found that the pores of the plywood are clogged with paste to the degree that the wood does not absorb the air or surface paste produced by certain high water-cementitious materials ratio admixtures.

3. Re-use of forms shall in no way delay or change the concrete placement schedule as 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).

3.06 CLEANING

A. Clean and re-oil formwork prior to re-use. Plywood forms may not be re-used if unused holes from form ties exist from a previous use.
## Concrete

**Spec Formliners, Inc.**

Impressive on Concrete

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**Concrete Forms and Accessories**

- **Property**: Tensile 638
  - **Value**: 3700
  - **HIPS**: 5300
  - **ABS**: 65

- **Property**: Flexural D706.5
  - **Value**: 5100
  - **HIPS**: 615

- **Property**: Hardness D786
  - **Value**: 105
  - **HIPS**:

**Material Weights - lbs/ft²**

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<td>0.180</td>
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<td>0.180</td>
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</tr>
<tr>
<td>0.145</td>
<td>0.155</td>
<td>0.180</td>
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<td>0.180</td>
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<tr>
<td>0.180</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

---

**ThermoSpec™ Single or Multi-use Plastic**

**Property**: Shore A/D
- **Value**: D2240
- **ASTM**: 401/95A

**Property**: Tensile
- **Value**: D412
- **ASTM**: 1900 psi

**Property**: Elongation
- **Value**: D412
- **ASTM**: 200%

**Property**: Tear Strength
- **Value**: D2370
- **ASTM**: 23 MPa

**Material Weights - lbs/ft²**

<table>
<thead>
<tr>
<th>Thickness</th>
<th>0.150</th>
<th>0.250</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.150</td>
<td>0.250</td>
<td></td>
</tr>
</tbody>
</table>

**Maximum Thickness**: 14" + Relief

---

**ElastoSpec Lite™ Semi-Elastomeric Multi-use Material**

**Property**: Shore A/D
- **Value**: D2240
- **ASTM**: 55-65

**Property**: Tensile
- **Value**: D412
- **ASTM**: 1400 psi

**Property**: Elongation
- **Value**: D638
- **ASTM**: 60%

**Property**: Tear Strength
- **Value**: D624
- **ASTM**: 200 psi

**Material Weights - lbs/ft²**

<table>
<thead>
<tr>
<th>Thickness</th>
<th>0.150</th>
<th>0.250</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.150</td>
<td>0.250</td>
<td></td>
</tr>
</tbody>
</table>

**Maximum Thickness**: Varies by Pattern

---

**ElastoSpec™ 100% Solid Urethane Bonded To 3/4" Plywood**

**Property**: Shore A/D
- **Value**: D2240
- **ASTM**: 55-65

**Property**: Tensile
- **Value**: D412
- **ASTM**: 1400 psi

**Property**: Elongation
- **Value**: D638
- **ASTM**: 60%

**Property**: Tear Strength
- **Value**: D624
- **ASTM**: 200 psi

**Material Weights - lbs/ft²**

<table>
<thead>
<tr>
<th>Thickness</th>
<th>0.150</th>
<th>0.250</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.150</td>
<td>0.250</td>
<td></td>
</tr>
</tbody>
</table>

**Maximum Thickness**: Varies by Pattern

---

**Call for ThermoSpec™ Standard Panel Sizes on this pattern. Custom Sizes and Art Panels available. ElastoSpec™ Customized Panel Sizes and Art Panels.**

**Spec Formliners, Inc.**

1038 E 4th Street, Santa Ana, CA 92701

www.specformliners.com - Phone: 714 429-9500 - FAX: 714 429-1460

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**END OF SECTION 03100**
PART 1– GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of all labor, materials, equipment and services necessary to furnish, fabricate and install epoxy-coated reinforcement for cast-in-place concrete, including reinforcing bars, welded wire fabric and accessories, as shown on the Contract Drawings, as specified herein and as required for a complete installation.

B. The work includes all incidental and miscellaneous items not specified under another section but required for the work of this Section, whether or not specifically referred to herein.

1.02 RELATED SECTIONS

A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02533 – Concrete Sidewalk
D. Section 03300 – Cast-in-Place Concrete
E. Section 03700 – Reinforced or Plain Cement

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01300:
   1. Shop Drawings:
      a. Detailed placing and shop fabrication drawings, for fabrications, bending and placement of concrete reinforcement in conformance with ACI 315.
      b. Shop Drawings shall show bar schedules, stirrup spacing, diagrams of bent bar arrangements and assemblies, arrangement of concrete reinforcement, including location and length of lap splices, and special reinforcement required at openings through concrete structures or at embeddings, supports, accessories, and concrete cover, to the extent necessary for proper fabrication and placement of concrete reinforcement.
      c. Shop Drawings shall be made to such a scale as to clearly show joint locations, openings, and the arrangement, spacing and splicing of reinforcement.
   2. Manufacturer’s specifications and installation instructions for all proprietary materials and reinforcement accessories.
   3. Mill specifications and test reports for reinforcing steel and welded wire fabric, showing physical and chemical properties.
   4. Description of proposed supports for each type and location of reinforcement.
   5. Description of reinforcing weld locations and weld procedures.
   6. Certification from an independent testing laboratory that mechanical connectors for reinforcing steel comply with specified requirements.
   7. Welders Certificates: Certify welders employed in the work, verifying AWS qualification within the previous 12 months.

B. Shop Drawings shall also indicate the following requests, as applicable:
   1. Request to relocate any bars that cause interferences or that cause placement tolerances to be violated.
2. Request to use splices not shown on the Contract Drawings.
3. Request to use mechanical couplers accompanied by manufacturer’s literature, installation instructions and certified load capacity test reports.
4. Request and procedure to field bend or straighten partially embedded reinforcing bars.

C. Develop Shop Drawings based upon field-verified dimensions and elevations of existing or partially constructed structures, where applicable, to allow proper review of drawings.

D. Prepare reinforcement placing drawings to provide a complete dimensioned representation of the arrangement of reinforcement to allow placement without reference to the design drawings, including location of support bars, chairs and bolsters, locations of construction and expansion joints, and sequence of concrete placements.

E. Prepare complete elevations of all walls and complete plans of all slabs, except where two or more walls or slabs are identical, and bill wall and slab reinforcing steel on such views. Prepare sections to clarify the arrangement of the steel reinforcement, and identify but do not bill wall and slab reinforcement in such sections. For all reinforcing bars, unless the location of the bar is clear, provide a dimension from the bar or bars to a readily distinguishable structural feature on the drawing to facilitate placement.

F. Check Shop Drawings for completeness, accuracy and necessary corrections prior to submittal for approval. Obtain the Project Manager’s approval of shop drawings prior to fabrication and installation.

G. Review of Shop Drawings will be for general considerations and design intent only. Compliance with specified requirements for materials, fabrication and placement of concrete reinforcement shall be the Contractor’s responsibility.

1.04 QUALITY ASSURANCE

A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.

1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
   a. PennDOT Publication 408, Specifications
   b. Bulletin 15, Approved Construction Materials

2. American Concrete Institute (ACI):
   a. ACI 301, Standard Specifications for Structural Concrete
   c. ACI 318, Building Code Requirements for Reinforced Concrete.
   d. ACI SP66, Detailing Manual.


   a. ASTM A82, Cold Drawn Steel Wire for Concrete Reinforcement.
   b. ASTM A185, Steel Welded Wire Fabric for Concrete Reinforcement.
   c. ASTM A496, Steel Wire, Deformed, for Concrete Reinforcement.
   d. ASTM A497, Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
e. ASTM A615/A615M, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
f. ASTM A 775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars
g. ASTM D3963, Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars

5. American Railway Engineering and Maintenance-of-Way Association (AREMA):
   a. AREMA Manual for Railway Engineering.


7. Society for Protective Coatings (SSPC) - formerly Steel Structures Painting Council, Steel Structures Painting Manual.
   a. SSPC-SP-10/NACE No. 2, Near-White Blast Cleaning.

B. Allowable Tolerances
   1. Fabrication: Deviations from indicated dimensions in excess of the following will not be permitted.
      a. Sheared length: 1 inch.
      b. Height of truss bars: 1/2 inch.
      c. Stirrups, ties, and spirals: 1/2 inch.
      d. Bent length: 1 inch.
   2. Placement: Conform to the requirements specified in ACI 318 and comply with CRSI recommended practice as specified herein.

C. Weld Qualification and Welder Qualifications: Depending on type of concrete reinforcement, perform welding of reinforcing steel using only welders qualified in accordance with ANSI/AWS D1.4. Perform welding procedure qualification, except for pre-qualified procedures, as required by ANSI/AWS D1.4 as applicable, prior to executing welding of reinforcing steel.

D. Inspection: Material and fabrication procedures are subject to inspection in the mill, shop and field by and at the discretion of the Project Manager or designated representative. Cooperate with and provide access for the Project Manager to conduct such inspections. Such inspection shall not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Ship concrete reinforcement from source in bundles of one size and length, securely tied and identified with plastic tag showing specification number, grade, heat number, bundle number, and name and location of mill.

B. Upon delivery to job site, store reinforcement in neat bundles, tagged for placement and properly identified for coordination with mill test reports.

C. Identify each group of bent and straight bars with a metal tag giving the identifying member corresponding to the shop drawing and bar schedule.

D. Bulk delivery of reinforcement steel will not be permitted.

E. Store reinforcement bars off the ground on platforms, skids, or other supports, and protect the reinforcement bars from mechanical injury and surface deterioration caused by exposure to conditions producing rust. Keep reinforcement bars free from frost, dirt, oil, grease, paint, mortar, loose rust, mill scale, and other materials that would reduce bond.
F. Handle and store epoxy-coated reinforcement bars by methods that will not damage the epoxy coating. Furnish all systems for handling epoxy-coated reinforcement bars with adequately padded contact areas if possible. Pad all bundling bands and lift all bundles with a strong back, multiple supports, or platform bridge to prevent bar-to-bar abrasion from sags in the bar bundle. Do not drop or drag bars or bundles. Transport and store epoxy-coated reinforcement bars on wooden or padded supports.

G. Where possible, do not store epoxy-coated reinforcement bars at the jobsite for more than 2 months. If field storage on site is expected to exceed 2 months, cover the epoxy-coated reinforcement bars or bundles with opaque polyethylene or other protective material. Provide ventilation to prevent condensation from forming under the covering.

H. Store, handle, and place epoxy-coated reinforcement bars at the jobsite according to ASTM D 3963/D 3963M. Inspect the bars before placement. If the epoxy coating is damaged and the damages do not exceed 2% of the surface area in any 1-foot section of the epoxy-coated reinforcement bars, repair all visible damage according to ASTM D 3963/D 3963M before bar placement. Replace epoxy-coated reinforcement bars if damage to the surface area exceeds 2% in any 1-foot section.

I. After placement, inspect the epoxy-coated reinforcement bars again and repair areas damaged during placement.

1.06 PROJECT CONDITIONS
A. Coordination:协调工作，与其他贸易的工作协调，避免施工延误。

B. Field Measurements
1. Prior to commencement of the work, field verify existing dimensions, elevations, locations and conditions applicable to the work. Report variances and discrepancies from the Contract Drawings and potential interferences promptly to the Project Manager.
2. Take sufficient field measurements prior to preparation of Shop Drawings and fabrication of construction materials, where possible, to ensure proper fitting of the work. However, do not delay job progress. Allow for adjustments and fitting wherever the taking of field measurements before fabrication may not be possible or might delay the work.
3. Actual field-verified conditions may require modifications to the construction details indicated on the Contract Drawings. Perform the work to meet actual field conditions encountered. Submit a record of variances and discrepancies on drawings to the Project Manager to document actual field-verified conditions.

PART 2– PRODUCTS

2.01 REINFORCEMENT MATERIALS
A. Reinforcement Steel - Reinforcement bars, PennDOT Publication 408, Specifications, Section 709.1. As indicated, provide epoxy coating for reinforcement bars as specified in PennDOT Publication 408, Specifications, Section 709.1(c).

2.02 MECHANICAL SPlice SYSTEM
A. From a manufacturer listed in Bulletin 15 and conforming to the following physical requirements:
1. Ultimate tensile strength of mechanical coupler system (California Test No. 670) - 90% of ultimate tensile strength of reinforcement bars, minimum
2. Allowable slip (California Test No. 670) - See Table A
3. Yield strength of mechanical coupler - 125% of specified yield strength of reinforcement bars, minimum 0.05 inch, maximum
4. Fatigue resistance, allowable slip (California Test No. 670, +25 kips per square inch to -25 kips per square inch for 10,000 cycles)

<table>
<thead>
<tr>
<th>Reinforcing Bar Number</th>
<th>Total Slip (inch), Maximum</th>
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<tbody>
<tr>
<td>3</td>
<td>0.010</td>
</tr>
<tr>
<td>4</td>
<td>0.010</td>
</tr>
<tr>
<td>5</td>
<td>0.010</td>
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<tr>
<td>6</td>
<td>0.010</td>
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<tr>
<td>7</td>
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<td>8</td>
<td>0.014</td>
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<td>9</td>
<td>0.014</td>
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<tr>
<td>10</td>
<td>0.018</td>
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<tr>
<td>11</td>
<td>0.018</td>
</tr>
<tr>
<td>12</td>
<td>0.024</td>
</tr>
<tr>
<td>13</td>
<td>0.030</td>
</tr>
</tbody>
</table>

5. Provide an epoxy-coated mechanical splice system to splice epoxy coated reinforcement bars. Epoxy coat the mechanical splice system to provide a coating thickness minimum of 7 mils to a maximum of 18 mils according to the following sections of ASTM A 775/A 775M:
   a. Scope - Section 1
   b. Referenced Documents - Section 2
   c. Terminology - Section 3
   d. Powder Coating - Section 5.2
   e. Patching Material - Section 5.4
   f. Surface Preparation - Section 6
   g. Coating Application - Section 7
   h. Coating Thickness Testing - Sections 8.1.2, 8.1.3 and 8.1.4
   i. Coating Adhesion - Section 8.4
   j. Retests - Section 10
   k. Repair of Damaged Coating - Sections 11.2, 11.3 and 11.5

B. SEPTA will select, for each size of epoxy coated reinforcement bar used, four splices, either sample or actual, three are to be assembled for testing to verify the physical properties and one is to remain unassembled for testing of coating thickness. Assemble samples or actual splices in the presence of SEPTA in accordance with the manufacturer's recommendations and splicing and lapping section below. Immediately package and deliver the samples to SEPTA. SEPTA will submit the field verification samples (Sample Class FV) to the LTS for testing and conformance to the specified requirements.

2.03 SUPPORTS FOR REINFORCEMENT

A. For Epoxy-Coated Reinforcement Bars, use plastic-coated or epoxy-coated tie wire. Use epoxy-coated, plastic-coated, or galvanized chairs and metal supports. Submit any proposed alternate support devices for acceptance. Use appurtenances with a minimum coating thickness of 3 mils to 4 mils.
2.04 WELDING

A. Do not weld Epoxy-Coated Reinforcement Bars.

PART 3– EXECUTION

3.01 GENERAL

A. Provide reinforcement bars free from injurious defects such as cracks and laminations. Provide reinforcement bars free from frost, dirt, oil, grease, paint, mortar, loose rust, mill scale, and other materials that would reduce bond. SEPTA will not reject reinforcement bars for bonded rust, surface seams, surface irregularities, or mill scale provided the minimum dimensions, cross-sectional area, and tensile properties of a hand wire brushed specimen meet the physical requirements for the size and grade of steel indicated.

B. Remove loose, scaly, or thick rust. A light powdery coating of rust, formed during project storage, does not require cleaning. SEPTA will reject reinforcement bars with rusting that has caused detectable reduction in cross-sectional area. Obtain SEPTA's acceptance of in-place reinforcement bars before concrete is placed. Maintain the reinforcement bars in the correct position.

C. Verify the compatibility of the bar schedule with the structure plans and details. Make adjustments to the bar schedule, including reinforcement bar details and quantities, and obtain the SEPTA's acceptance before fabrication. SEPTA will not grant additional Contract time as a result of adjustments to the bar schedule or to reinforcement bars.

3.02 EXAMINATION

A. With each shipment of reinforcement bars delivered to the project, have the material supplier furnish a bill of lading that provides an itemized listing, as shown on the bar schedule for individual structural units, of all bars in the shipment by quantity, size, length, mark, type, weight, and bending dimensions, as indicated. Include general project identification information as well as any appropriate remarks and plan references (drawing number, description, etc.) on the bill of lading. Submit bills of lading to SEPTA inspection personnel to verify and document field quantities and for the Department's project records.

3.03 FIELD ADJUSTMENT

A. Furnish bars with shapes and dimensions, as indicated. Do not field bend except to make minor adjustments when approved by the Project Manager. If field bending or straightening is required, see Table B. Do not field bend rail or axle steel. Field bend uncoated, corrosion-resistant steel reinforcement bars at ambient temperature and do not bend or straighten bars in a manner that will damage the material. Heating of the uncoated, corrosion-resistant steel reinforcement bars to facilitate bending is not allowed. Cut uncoated, corrosion-resistant steel reinforcement bars by shearing or with a fluid-cooled saw. Torch cutting of uncoated, corrosion-resistant steel reinforcement bars is not allowed.
TABLE B - Bend and Straightening Requirements\(^{(1)}(2)\)

<table>
<thead>
<tr>
<th>Bar Size</th>
<th>Carbon Equivalent</th>
<th>Bend Temp. F</th>
<th>Straighten Temp. F</th>
<th>Bar Size</th>
<th>Dia. of Former Inches Min.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1400-1500</td>
<td>1400-1500</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>0.55 or less and A 706</td>
<td>70-100 or 1400-1500</td>
<td>70-100 or 1400-1500</td>
<td>6</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Any</td>
<td>1400-1500</td>
<td>1400-1500</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>&gt;8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^{(1)}\) Use temperature sticks.
\(^{(2)}\) Avoid:

- 450F to 600F
- 1800F and greater

Note:

1. Apply heat to sufficient area to encompass bend area.
2. Apply heat for sufficient time to bring bar center to required temperature.
3. Maintain temperature while bending and/or straightening.
4. Allow free rotation.
5. Bend with smooth continuous application of force.
6. Straighten by moving hickey bar (if used) progressively around bend.

3.04 INSTALLATION

A. Accurately place reinforcement bars as indicated and hold it firmly in position during the placing and settling of concrete using metal chairs or acceptable supports.

B. Do not allow bar spacing to vary from the design spacing by more than 1/2 inch.

C. Do not allow the distance from the surface of the formwork to the bars to vary more than 1/4 inch from the design distance.

D. Do not place reinforcement bars closer than 1.5 times the maximum nominal size of the aggregate used in the concrete mix design.

E. Firmly tie bars with annealed iron wire or secure the bars with acceptable metal clips. Tie bars at all perimeter intersections and at all intersections on the top mat of bridge decks and in bridge barriers. For other intersections, when bar spacing is greater than or equal to 12 inches, tie all intersections; when bar spacing is less than 12 inches, either tie all intersections or tie alternate intersections in each direction to provide a staggered tie layout.

F. Tie bundled bars together at not more than 6-foot centers. When reinforcement bars are tied together and lifted into place as a unit, ensure stability of the unit and maintain proper bar alignment during lifting and placement operations.

G. For epoxy-coated reinforcement bars, provide plastic-coated tie wire, epoxy-coated tie wire, metal clips, or plastic clips.

H. If fabric reinforcement is shipped in rolls, straighten it into flat sheets before placing it. Do not weld cross bars (tack weld) for assembly of reinforcement bars unless authorized in writing by SEPTA.
3.05 SUPPORTS AND SPACERS FOR REINFORCEMENT AND WELDED WIRE REINFORCEMENT

A. Support reinforcement bars in its proper position by use of mortar blocks, wire bar supports, supplementary bars, or other devices. Supply such devices of proper height and at sufficiently frequent intervals to maintain the distance between the reinforcement bars and the formed surface or the top surface of deck slabs within 1/4 inch of that indicated.

B. Support platforms, supporting personnel and equipment during concrete placement, directly on the forms and not on the reinforcement bars.

1. Mortar Block Supports - Furnish mortar blocks of the same class as the concrete in which they are to be embedded. Ensure that block faces in contact with forms for exposed surfaces do not exceed 2 inches by 2 inches in size, and that their color and texture will match the concrete surface. If used on vertical or sloping surfaces, provide such blocks with an embedded wire for securing the block to the reinforcement bars. If used in slabs, use either a tie wire or, if the gravitational force of the reinforcement bars is sufficient to firmly hold the blocks in place, a groove in the top of the block. For epoxy-coated reinforcement bars, use plastic-coated or epoxy-coated tie wires.

2. Wire Supports - Furnish wire bar supports, such as ferrous metal chairs and bolsters conforming to industry practice as described in the Manual of Standard Practice of the Concrete Reinforcing Steel Institute. Ensure that chairs or bolsters that bear against the forms for exposed surfaces are either Class 1 - Maximum Protection (Plastic Protected) or Class 2, Type B - Moderate Protection (Stainless Steel Tipped) for which the stainless steel conforms to ASTM A 493, Type 430. For epoxy-coated reinforcement bars, provide plastic-coated, epoxy-coated, or galvanized wire bar supports and bar clips.

3. Plastic Supports - Use chairs and bolsters that do not deflect more than 1/4 inch under the minimum point load requirement of 350 pounds-force as described in PTM No. 430. Use supports molded in a configuration that does not restrict concrete flow.

3.06 SPLICING AND LAPPING

A. Furnish all reinforcement in the full lengths, as indicated, unless otherwise allowed by SEPTA.

B. Do not splice bars, except as indicated or directed. If splicing is allowed, lap the reinforcement bars as shown on PennDOT Standard Drawings and as indicated, and wire together securely. Do not substitute alternate bars unless allowed by SEPTA. Stagger splices as far as possible.

C. In lapped splices, place and wire the bars maintaining the minimum distance to the surface of the concrete as indicated. Do not use lapped splices for Nos. 14 and 18 bars, except as provided in Articles 5.11.5.2.1 and 5.11.5.5.1 of the AASHTO LRFD Specification.

D. As indicated, use welded splices or mechanical splice systems. For welded splices, use butt splices only. Stagger welded splices or mechanical splice system connections if possible. Do not weld uncoated, corrosion-resistant steel reinforcement bars.

E. Only use welded splices if indicated or if the Chief Bridge Engineer gives written authorization to do so. Ensure that welding conforms to the Structural Welding Code, Reinforcing Steel, AWS D1.4 of the American Welding Society and applicable special provisions.

F. Do not use welded splices on epoxy-coated reinforcement bars. Do not weld so close to epoxy-coated reinforcement bars to cause any heating of the coating.
G. Assemble all mechanical splice systems according to the manufacturer’s recommendations. Furnish a copy of the manufacturer’s recommendations to SEPTA. Mark reinforcing bars with scribe marks or indelible ink before splice attachment to ensure equal embedment.

H. When epoxy coated mechanical splice systems are used, clean, assemble and repair any visible damage to the coating with an acceptable repair material according to the manufacturer’s recommendations. For epoxy coated mechanical splice systems, seal off the epoxy coated rebar at the point of entry into the mechanical coupler using an acceptable epoxy repair material.

I. Do not encase mechanical splices in concrete until visual examination and required testing have been completed and approved.

END OF SECTION 03200
PART 1– GENERAL

1.01 DESCRIPTION
A. This work is construction of bridges, arches, culverts, and other cement concrete work.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 03100 – Concrete Forms and Accessories
D. Section 03200 – Concrete Reinforcement

1.03 SUBMITTALS
A. Submit the following in accordance with Section 01300:
   1. Proposed design mix for each class of concrete and for each proposed change of ingredients and ingredient sources, including admixtures, in accordance with the documentation provisions of ACI 301. Identify for each mix design submitted the method by which proportions have been selected.
      a. For mixture designs based on trial mixtures, include laboratory trial mixture proportions, test results and graphical analysis, and indicate required average compressive strength, f’c, developed at 7 and 28 days from not less than 3 test cylinders cast for each test and for each design mixture.
      b. Indicate source and aggregate gradation for fine and coarse aggregates.
      c. Indicate quantity of each ingredient per cubic yard of concrete.
      d. Indicate type and quantity of admixtures proposed or required.
      e. Submit for approval new historical field strength test data, data from new trial mixtures or evidence which indicates that the change will not adversely affect the relevant properties of the concrete prior to changing the brand, type, size or source of cementitious materials, aggregates, water, ice or admixtures.
   2. Certifications by the concrete supplier of conformance of all concrete ingredients to the specified requirements and manufactured and delivered in accordance with ASTM C94. Be advised that the proposed concrete supplier is subject to SEPTA approval based on experience and past performance on similar projects.
   3. Certifications by the concrete supplier of conformance to design mixes.
   4. Manufacturer’s certification that chloride content of each concrete admixture complies with specified requirements.
   5. Manufacturer’s technical data and installation instructions for manufactured materials and products. Furnish manufacturer’s certifications and laboratory test reports as requested by the Project Manager. Submit notarized certification of conformance to referenced standards when requested by the Project Manager.
   6. Equipment and method(s) of concrete pumping and conveying.
   7. Method(s) of concrete placement.
   8. Method(s) of concrete curing and protection.
10. Method of insulation and heating of the deck areas to the Project Manager for review and approval before placing concrete.

11. Test Reports
   a. Submit proposed laboratory trial mix designs or consecutive test results and the mix design used from a record of past performance in accordance with ACI 301.
   b. Submit copies of laboratory test reports for concrete materials and mixture design tests. Project Manager's review will be for information only. Production of concrete to comply with the specified requirements shall be the responsibility of the Contractor.
   c. Cement: Submit test results in accordance with ASTM C150 Portland Cement and/or ASTM C595 for blended cement. Submit current mill data.
   d. Fly Ash: Submit test results in accordance with ASTM C618. Submit test results performed within 6 months of submittal date.
   e. Ground Granulated Blast-Furnace Slag: Submit test results in accordance with ASTM C989 for ground iron blast-furnace slag. Submit test results performed within 6 months of submittal date.
   f. Silica Fume: Submit test results in accordance with ASTM C1240 for silica fume. Submit test results performed within 6 months of submittal date.
   g. Aggregates: Submit test results for aggregate quality for normal weight concrete in accordance with ASTM C33, the combined graduation curve for grading proposed for use in the work and used in the mixture qualification. Where there is potential for alkali-silica reaction, provide results of tests conducted in accordance with ASTM C227. Submit results of all tests during progress of the work in tabular and graphical form as noted above, describing the cumulative combined aggregate grading and the percent of the combined aggregate retained on each sieve.
   h. Admixtures: Submit test results in accordance with ASTM C494 and ASTM C1017 for concrete admixtures and ASTM C260 for air-entraining agent. Submitted data shall be based upon tests performed within 6 months of submittal.
   i. Submit copies of laboratory test reports for concrete materials and mixture design tests. The Engineer's review will be for information only. Production of concrete to comply with the specified requirements shall be the responsibility of the Contractor.
   j. A complete record of the date and details of each concrete placement including the exact location thereof and the date of removal of forms. This record shall be coordinated with and in addition to that maintained by the Project Manager.

12. Proposed concrete placement schedule prior to start of concrete placement operations, including location of all construction, expansion and control joints.

13. Proposed equipment and method(s) of concrete pumping and conveying; concrete placement, vibration and compaction; concrete curing; and hot and cold weather mixing, placement, curing and protective measures.

14. Proposed special procedures for protection of concrete under wet weather placement conditions.

15. Detailed procedures for removing stains, rust, efflorescence and surface deposits from exposed cast-in-place concrete surfaces.

16. Delivery Tickets
   a. Furnish Project Manager with a copy of the delivery ticket for each load of concrete delivered to the site. Delivery tickets shall contain all information specified in Section 16.1 of ASTM C94.
   b. Provide batch tickets for each batch of job-site mixed concrete as specified.
17. Form removal schedule.

B. For quality control submittal requirements, refer to Section 01400

1.04 QUALITY ASSURANCE

A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. AASHTO M182, Burlap Cloth Made from Jute or Kenaf.

2. American Concrete Institute (ACI):
   b. ACI 201.2R, Guide to Durable Concrete.
   c. ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   d. ACI 301, Standard Specifications for Structural Concrete.
   e. ACI 302.1, Guide for Concrete Floor and Slab Construction.
   f. ACI 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
   g. ACI 304.2R, Placing Concrete by Pumping Methods.
   h. ACI 305R, Hot Weather Concrete.
   i. ACI 306R, Cold Weather Concrete.
   j. ACI 308, Standard Practice for Curing Concrete.
   k. ACI 309R, Guide for Consolidation of Concrete.
   l. ACI 318, Building Code Requirements for Structural Concrete and Commentary.

   a. ASTM C31, Making and Curing Concrete Test Specimens in the Field.
   b. ASTM C33, Concrete Aggregates.
   c. ASTM C39, Compressive Strength of Cylindrical Concrete Specimens.
   d. ASTM C42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
   e. ASTM C94, Ready-Mixed Concrete.
   f. ASTM C143, Test Method for Slump of Hydraulic Cement Concrete.
   g. ASTM C150, Portland Cement.
   h. ASTM C156, Test Method for Water Retention by Concrete Curing Materials.
   i. ASTM C171, Sheet Materials for Curing Concrete.
   j. ASTM C172, Sampling Freshly Mixed Concrete.
   k. ASTM C173, Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
   m. ASTM C231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   n. ASTM C260, Air-Entraining Admixtures for Concrete.
   o. ASTM C309, Liquid Membrane-Forming Compounds for Curing Concrete.
   p. ASTM C470, Molds for Forming Concrete Test Cylinders Vertically.
   q. ASTM C494, Chemical Admixtures for Concrete.
   r. ASTM C595, Blended Hydraulic Cements.
   s. ASTM C618, Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
t. ASTM C827, Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.

u. ASTM C881, Epoxy-Resin-Base Bonding Systems for Concrete.

v. ASTM C920, Elastomeric Joint Sealants.

w. ASTM C989, Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.

x. ASTM C1017, Chemical Admixtures for Use in Producing flowing Concrete.

y. ASTM C1077, Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

z. ASTM C1107, Packaged Dry, Hydraulic - Cement Grout (Non-shrink).

aa. ASTM C1240, Silica Fume Used in Cementitious Mixtures.

bb. ASTM D1752, Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

4. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
   a. PennDOT Publication 408, Specifications
   b. Bulletin 15, Approved Construction Materials

B. Concrete Testing Services
   1. Engage a Testing and Inspection Agency to develop mix designs and to perform material evaluation tests.
   2. Testing agencies engaged by the Contractor that perform testing services on concrete materials shall meet the requirements of ASTM C1077.
   3. Submit qualifications of the proposed Testing and Inspection Agency for approval by SEPTA in accordance with Section 01410.

C. Use adequate number 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.

D. Comply with ACI 301, "Standard Specifications for Structural Concrete", except as may be modified herein.

E. Work in Connection with Other Sections:
   1. Provide all sleeves, inserts, anchors and embedded items required for adjoining work or for its support prior to concreting. No concrete shall be deposited until the Project Manager or authorized representative has inspected the placement of the embedded items and the reinforcing bars and has given permission to place the concrete.
   2. Provide ample notice and opportunity to other trades, whose work is related to the concrete or must be supported by it, to introduce and furnish embedded items before the concrete is placed.
   3. Permit other trades to install electrical conduits, junction boxes, sleeves, and pipes prior to concreting. Cooperate in the installation of such items of work in order that they are installed in accordance with all applicable regulatory requirements. Protect such installations to the extent that they are not displaced or damaged during the concrete placement.
   4. Provide openings in slabs for sleeves, pipes, conduits and the like required for the work of others where indicated on the Contract Drawings or Shop Drawings for which directions are given prior to placing concrete. When work of others is completed, close up the excess part of the respective openings completely to the pipe sleeve and inserts to match the adjoining work.
   5. Provide and set true and to proper alignment in the concrete all sleeves for miscellaneous metal work, castings, pipes and anchors required under this or other
Contracts as indicated on the Contract Drawings or required by the manufacturer’s templates.

6. Temporarily fill voids in embedments with readily removable material to prevent entry of concrete into the void.

F. Do not commence furnishing or placement of normal weight structural concrete or normal weight concrete fill until mix designs have been reviewed and approved by the Project Manager.

G. Closely coordinate the work of this Section with other trades whose work affects, or is affected by, the work of this Section

1.05 DEFINITIONS

A. Cementitious Material: As used herein, shall include Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, or ground granulated blast-furnace slag and silica fume.

B. Design Strength (f’c): The specified compressive strength of concrete to meet structural design criteria.

C. Exposed Finish: A general use finish applicable to all formed concrete exposed to view including surfaces which may receive a paint coating.

D. Field Test Strength (fcr): The required compressive strength of concrete to meet structural and durability criteria. Determine (fcr) during mixture proportioning process.

E. Mixture Proportioning: A description of the proportions of a concrete mixture that are selected to enable it to meet the performance durability requirements, workability, specified compressive strength, and constructability requirements.

F. Mixture Proportions: The concrete supplier’s by-mass proportions to replicate the mixture design.

G. Normal Weight Concrete: Concrete for which density is not a controlling attribute, produced with aggregates stipulated under ASTM C33, and having a unit weight in the range of 135 to 160 lbs. per cubic foot.

H. Unexposed Finish: A general use finish, with no appearance criteria, applicable to all formed concrete concealed from view after completion of construction.

1.06 DESIGN AND PERFORMANCE REQUIREMENTS

A. General: Cast-in-place concrete shall comply with the applicable requirements of ACI 301 and ACI 318.

B. All exposed normal weight cast-in-place structural concrete that may become exposed to freezing and thawing or deicing chemicals shall comply, as a minimum, with the severe exposure requirements for frost-resistant concrete as described in ACI 318, Section 4.2.

C. Design and proportion concrete mixtures to provide an average 28-day compressive strength in excess of the specified 28-day design compressive strength so that the minimum ultimate compressive strength required for each strength class will be obtained.

D. Design Mix Basis and Criteria:
   1. Applicable to cast-in-place structural normal weight concrete and concrete fill for use in bridges and other structures unless specified otherwise. Mix designs shall indicate the location of each mix within the project limits.
   2. Proportion trial mixtures, including the molding and curing of test specimens, or assemble field test data as appropriate, for each class of concrete. Proportion normal
weight concrete in accordance with the recommendations of ACI 211.1. Establish mixture proportions based on trial mixtures or documented field test data for each design mix and prepare the required computations from the results of the test specimens in accordance with the provisions of ACI 301.

3. Base the concrete design on the materials to be used in the work. If the specified requirements cannot be met, furnish other acceptable materials and/or make necessary changes in the mixing procedure to meet the specified requirements.

4. Design mixture shall meet or exceed each specified property or requirement. Where more than one criterion is specified, conform to the most stringent. For example, a minimum cementitious content or maximum water-cementitious ratio may result in compressive strengths greater than the minimum specified. Likewise, a greater cement content or lower water-cementitious ratio may be required to achieve the required compressive strength.

5. At the start of construction, mix a full-sized batch, using the accepted materials, the type of mixer and the mixing procedure planned for the project to verify the adequacy of the selected proportions to produce concrete with the required total air content and consistency, and with workability compatible with the intended placing method. This batch will provide the basis for final adjustment of the accepted design.

6. Adjustment to Concrete Mixtures: Mixture design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Submit laboratory test data for revised mixture design for the Project Manager’s approval prior to using the revised mixture design in the work. Mixture design adjustments shall be at the sole expense of the Contractor.

7. The requirement for a trial batch may be waived if the required test information has been provided in a previous laboratory trial batch run on the identical mixture design within the previous two years. The same brand, type, and source of all materials shall have been used.

8. The use of PennDOT approved mixes is acceptable where they comply with specified design requirements. The use of PennDOT approved design mixes does not relieve the Contractor from the requirement to submit a design mix for approval.

9. Concrete mixes for concrete to be placed by pumping shall be designed in accordance with the applicable requirements of ACI 304R and ACI 304.2R, including compressive strength and slump.

E. Testing and Inspection:

1. Materials, delivery and placement or installation procedures are subject to inspection and testing at the concrete or manufacturing plant and in the field, conducted by the Testing and Inspection Agency in accordance with the requirements of Section 01410. Such inspections and tests shall not relieve the Contractor of responsibility for providing materials, placement or installation procedures and finished products in compliance with specified requirements.

2. The Project Manager may elect to accept certificates of compliance for materials and products in lieu of specified testing procedures. Conform to the requirements of Section 01400.

F. Measurements and Allowable Tolerances: Conform to requirements of cited Reference Standards but provide more restrictive tolerances where required to meet job conditions.

1. Concrete work at exposed surface conditions, including slabs, beams, and walls shall not deviate more than 1/2 inch from theoretical design locations. Pile caps shall not deviate more than 1 inch from theoretical design locations.

2. Variation from a 10-foot straightedge placed in all directions:

   a. Horizontal and inclined surfaces: 1/8 inch.
3. Eliminate depressions on horizontal surfaces which could hold water.
4. Out-of-plumb piers, walls, and joints: 1/4 inch in 10 feet, not to exceed one inch total.
5. Level and grade of slab soffits, beam soffits, and arises: 1/4 inch in any 10 feet length; 3/8 inch in any 20 feet length; not to exceed 3/4 inch for entire surface.
6. Cross sectional dimensions of beams, and slabs: Plus 1/4 inch, minus 0.
7. Size and location of sleeves, floor openings, inserts and anchor bolts: 1/4 inch.
8. Difference between the diagonal dimensions of a rectangular opening: Not more than two percent of the sum of the diagonal dimensions.
9. Tolerances shall not be cumulative.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Cement shall be stored in weather-tight buildings, bins or silos which will provide protection from dampness and contamination and will minimize warehouse set.

B. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation or contamination with other materials or with any other sizes of like aggregates. To insure that this condition is met, any test for determining conformance to requirements for cleanliness and grading shall be performed on samples secured from the aggregates at the point of batching. Frozen or partially frozen particles shall not be used.

C. Stockpiles of natural or manufactured sand shall be allowed to drain freely to minimize variations in moisture content throughout the stockpile.

D. Admixtures shall be stored in such a manner as to avoid contamination, evaporation or damage. For those used in the form of suspensions or non-stable solutions, suitable agitating equipment shall be provided to assure uniform distribution of the ingredients. Liquid admixtures shall be protected from freezing and other temperature changes that would adversely affect their characteristics. All admixture containers shall be clearly marked with paint as to their content and dosage.

E. Do not deliver concrete until forms, reinforcement, embedded items, and chamfer strips are in place and ready for concrete placement.

1.08 PROJECT CONDITIONS

A. Coordination: Coordinate work of this Section with the work of other trades to avoid construction delays.

B. Field Measurements
   1. Prior to commencement of the work, field-verify existing dimensions, elevations, locations and conditions applicable to the work. Report variances and discrepancies from the Contract Drawings and potential interferences promptly to the Project Manager.
   2. Take sufficient field measurements prior to preparation of Shop Drawings and fabrication of construction materials, where possible, to ensure proper fitting of the work. However, do not delay job progress. Allow for adjustments and fitting wherever the taking of field measurements before fabrication may not be possible or might delay the work.
   3. Actual field-verified conditions may require modifications to the construction details indicated on the Contract Drawings. Perform the work to meet actual field conditions encountered. Submit a record of variances and discrepancies on drawings to the Resident Engineer to document actual field-verified conditions.
PART 2– PRODUCTS

2.01 CONCRETE QUALITY AND PROPORTIONING

A. Adjust the concrete 28-day design compressive strength as necessary to produce cast-in-place concrete of minimum ultimate compressive strength ($f'_c$) as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Minimum Ultimate, 28-day Compressive Strength, $f'_c$ (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class AAAP (Sleeper Slab, Approach Slab, Deck Slab, Trolley Slab, Concrete Diaphragms and Bridge Sidewalk Slabs)</td>
<td>4,000</td>
</tr>
<tr>
<td>Class AA (Concrete Barriers, U-wings above Bridge Seat Construction Joint, Approach Sidewalk Slabs and Cheekwalls)</td>
<td>3,500</td>
</tr>
<tr>
<td>Class A (Abutments and U-Wings below Bridge Seat, Pedestals, Footings and Retaining Wall Modifications)</td>
<td>3,000</td>
</tr>
<tr>
<td>Class C (Below bottom of footing)</td>
<td>2,000</td>
</tr>
</tbody>
</table>

2.02 MATERIALS

A. Cement. Concrete. PennDOT Publication 408, Section 704. The cement factor may be increased to obtain High Early-Strength concrete, with written consent from the Project Manager. Do not use Type III High Early-Strength, non-air-entraining cement.

B. Structure Foundation Drains. PennDOT Publication 408, Section 610.2 and PennDOT Publication 408, Section 615.2

C. Bituminous Tack Coat (for Bridge Decks). PennDOT Publication 408, Section 460.2

D. Lighting Pole Anchorage. Provide as shown on the Standard Drawings and as follows:
   1. Anchor Bolts, Nuts, and Washers—PennDOT Publication 408, Section 1105.02(c)2 (metallic coated)
   2. Steel Angle—PennDOT Publication 408, Section 1105.02(a)2
   3. Conduit—PennDOT Publication 408, Section 1101.09(b)
   4. Junction Box—PennDOT Publication 408, Section 1101.10

E. Forms.
   1. Temporary. Use plywood at least 5/8 inch thick or other accepted material made for form work. For final exposed concrete surfaces, use smooth material, free of knots, holes, bulges, and depressions.
   2. Metal Bridge Deck Forms. Use permanent forms, fabricated from steel conforming to ASTM A 924/A 924M and ASTM A 653/A 653M (Structural Quality (SQ) excluding Grade 50 Class 3), with a coating designation of G165, and a minimum thickness of 22 gauge. Coat fasteners, if used, either by galvanizing according to ASTM A 153 or ASTM B 633, Thickness Class Fe/Zn 12; or cadmium plating, according to ASTM B 766, Class 12.
a. An alternate form system may be used, if indicated or if accepted in writing by the Chief Bridge Engineer. Submit material details and erection methods of the alternate form system for review and acceptance.

b. Certify as specified in PennDOT Publication 408, Section 106.03(b)3.

F. Tremie Cement Concrete. Use Class A cement concrete as specified in PennDOT Publication 408, Section 704, modified as follows:
   1. Cement Factor (Min.) — 7.0 bags per cubic yard
   2. Slump—7 inches ± 1 inch
   3. Compressive Strength at 7 Days—2,000 pounds per square inch
   4. Provide admixtures that retard concrete set 5 feet above and below the tremie pipe outlet, are compatible with the air entrainment agents, and do not allow excessive segregation of the aggregate.

G. Concrete Bonding Compound. PennDOT Publication 408, Section 706

2.03 CURING AND PROTECTION MATERIALS
A. Concrete Curing Material and Admixtures.
   1. Curing and Protecting Covers—PennDOT Publication 408, Section 711.1
   2. Concrete Admixtures—PennDOT Publication 408, Section 711.3 Do not use admixtures containing chloride salts in bridge-deck concrete.

2.04 EPOXY BONDING AGENT
A. Not used

2.05 PRE-FORMED COMPRESSIBLE JOINT FILLER
A. Premolded Expansion Joint Filler—PennDOT Publication 408, Section 705.1

2.06 JOINT SEALANT AND BACKER ROD
A. Joint Sealing Material—PennDOT Publication 408, Section 705.4(b), (c), or (d)

2.07 EPOXY RESIN FOR GROUTING DOWELS
A. Not used

2.08 NON-SHRINK GROUT
A. Nonstaining, Nonshrinking Grout. Use for minor patching of concrete surfaces. Mix one part cement, two parts fine aggregate, and enough water to provide a consistency stiff enough to place by either manual or mechanical tamping. Do not use more than 4 1/2 gallons of water per bag of cement. Mix for 60 seconds, cover to prevent loss of moisture, and allow to stand for 45 minutes. Remix for 60 seconds without further addition of water, then place within 30 minutes after completion of mixing. Use material as follows:
   1. Cement, Type IP, IS, or II—PennDOT Publication 408, Section 701
   2. Fine Aggregate, Type A or C—PennDOT Publication 408, Section 703.1
   3. Water—PennDOT Publication 408, Section 720.1
4. The Contractor may use premixed grout. Obtain from a manufacturer listed in Bulletin 15. Mix according to the manufacturer's instructions. Certify as specified in PennDOT Publication 408, Section 106.03(b)3.

B. Nonshrink Grout for Studs, Dowels, and Anchor Bolts. PennDOT Publication 408, Section 1080.2(c), except use Type C fine aggregate.
   1. The Contractor may use premixed nonshrink grout. Obtain a grout, which passes a No. 8 sieve, from a manufacturer listed in Bulletin 15. Mix according to the manufacturer’s instructions. Certify as specified in PennDOT Publication 408, Section 106.03(b)3.

2.09 MISCELLANEOUS MATERIALS
A. Other Material.
   1. Closed Cell Neoprene Sponge—PennDOT Publication 408, Section 1107.02(p)1
   2. Waterstops—PennDOT Publication 408, Section 705.5
   3. Caulking Compound—PennDOT Publication 408, Section 705.8
   4. Reinforcement—PennDOT Publication 408, Section 1002.2
   5. Steel Welded Wire Fabric—PennDOT Publication 408, Section 709.3
   6. Deformed and Plain Bar Dowels—PennDOT Publication 408, Section 709.1
   7. Structural Steel—PennDOT Publication 408, Section 1105
   8. Waterproofing—PennDOT Publication 408, Section 680.2
   9. Coarse Aggregate, No. 57—PennDOT Publication 408, Section 703.2
  10. Conduits and Conduit Protective Coating—PennDOT Publication 408, Sections 1101.09(b) and (d)
  11. Selected Borrow Excavation—Structure Backfill, as shown on the Standard Drawings.
  12. Anchor Bolts—PennDOT Publication 408, Section 1105.02(c)2
  13. Bituminous Material, Class RC-250—PennDOT Publication 408, Section 702
  14. Geotextiles, Class 1—PennDOT Publication 408, Section 735
  15. Polyethylene Sheeting—PennDOT Publication 408, Section 505.2
  16. Bituminous Paper – PennDOT Publication 408, Section 727
  17. Asphalt Cement, PG 64-22 – PennDOT Publication 408, Section 702

PART 3– EXECUTION

3.01 EXAMINATION
A. In the presence of the Project Manager or designated representative, examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected and approval has been given by the Project Manager.
B. For concrete footings and foundations, verify that subbase materials are properly compacted and in acceptable condition upon which to construct cast-in-place structural concrete.

C. Verify that concrete formwork is properly constructed in conformance with Section 03100 - Concrete Forms and Accessories.

D. Verify requirements for concrete cover to reinforcement are satisfied.

E. Verify that reinforcement, anchors, inserts, sleeves and other embedded items are accurately placed, are secured in position and will not interfere with proper placement of concrete as specified in Section 03200 - Concrete Reinforcement.

3.02 EXCAVATION

A. Excavate as required. Remove existing curb, pavement, and sidewalk to neat lines when indicated, then compact the material, upon which the curb is to be constructed, to a firm even surface.

3.03 JOINT CONSTRUCTION

A. Joints. Rivet or fold-seam the splices of metal waterstops before soldering. Make splices for rubber, plastic and similar waterstops according to the manufacturer's recommendations.

B. If the construction plane is to be horizontal and concrete placement is stopped for more than 30 minutes, provide acceptable keyways and sufficient dowel bars.

C. When directed, place vertical construction joints, then place acceptable dowel bars as required.

3.04 BATCHING, MEASURING, MIXING AND TRANSPORTING CONCRETE

A. Mixing Conditions. PennDOT Publication 408, Section 704.1(f)

B. Proportioning and Mixing Concrete. PennDOT Publication 408, Section 704

C. Consistency of Concrete at the Time of Placement. Do not add water to concrete in the field, unless authorized in writing by SEPTA. If written authorization is obtained, the quantity of water may be increased by a maximum of 1 gallon per cubic yard. Immediately remove free water, soft concrete, or mortar that appears on the surface of the concrete, and correct the cause of this condition.

3.05 PLACING CONCRETE

Placing and Finishing Concrete.

A. General Requirements. At least 15 days before the element of work is started, submit, for review and acceptance, a QC Plan showing the methods, sequence, and schedule for placing concrete. Maintain material on hand and in place, if necessary, for curing and protecting the concrete. Before placing foundation concrete, ensure that the bearing area is firm, reasonably dry, and free of water. The Project Manager will inspect the foundation area for bearing capacity before placement. If directed, drill or drive a bar into the material below the foundation or footing bottom to a depth sufficient to determine the suitability of the material. Place concrete without segregation. Remove and discard any concrete that is segregated, too wet for use, or not of uniform consistency. Do not drop the concrete mixture a distance greater than 4 feet. Do not allow concrete to come in contact with aluminum, unless the aluminum is coated with an accepted coating. Do not place consecutive batches adjacent to each other at concrete temperatures differing by more than 20F. Do not place concrete upon frozen foundation material, in forms containing frost, around frosted
reinforcement, or in pile shells surrounded by ice or frozen earth. For succeeding batches, place concrete in the forms within 30 minutes. Place concrete in horizontal layers no more than 15 inches in depth. Fill each part of the form by depositing the concrete as close to its final position as possible. Do not work or flow concrete along the forms from the point of deposit. Work the concrete without displacing the reinforcement. Place concrete so that the upper surface of the concrete is at the indicated elevation after it has been struck off and after initial shrinkage has taken place. Finish exposed concrete surfaces accurately and evenly, free from open and rough areas, and free from depressions and projections. In bridge seats and walls, place concrete to the required elevation. Strike off with a straightedge and float to the correct elevation. Do not add water or curing agent to the concrete surface to assist in finishing. Finish bearing areas of substructures, as specified in PennDOT Publication 408, Section 1001.3(k)9. In areas where reinforcement extends through a construction joint, do not place concrete adjacent to previously placed concrete until at least 24 hours has elapsed.

B. Use of Vibrating Equipment. Keep sufficient vibration equipment in reserve to guard against a work shutdown, caused by the failure of the equipment in operation. Use an acceptable mechanical vibrator. Do not attach it to the forms or reinforcement. Use a vibrator capable of transmitting vibration to the concrete with a frequency of not less than 100 impulses per second. Determine the vibrator size by the reinforcement spacing. When sufficient concrete has been deposited, spade and manipulate it to fill the form. Apply the vibrator to the concrete, at intervals not exceeding 3 feet, immediately after the concrete has been deposited. Move the vibrator throughout the mass, completely working the concrete around the reinforcement and other embedded fixtures, and into the corners and angles of the forms. Correct any reinforcement displacement caused by the vibrator before continuing vibration. Move the vibrator slowly to prevent segregation. Do not use vibrators to spread concrete. Remove and discard concrete segregated by the vibrating operation. Ensure that the vibrator does not penetrate or disturb partially hardened layers. Reinforcement in freshly placed concrete may be vibrated for short durations to ensure proper reinforcement embedment.

C. Placing Concrete in Water.
1. General. When the depth of water in the foundation area is 1 inch or greater, place concrete only in still water and add 25% more cement than the quantity specified for the concrete class being used, as specified in PennDOT Publication 408, Section 704.1(h). Do not deposit concrete in water having a temperature below 40F. Hold a concrete placement meeting and present all details of the placement to the Project Manager. Do not begin concrete placement until the placement procedures, concrete mix design, inspection procedures, and concrete sampling procedures have been accepted. If the tremie method is selected for placing concrete, submit a concrete placement procedure plan for approval at least 21 calendar days before performing the work, and include the following:
   a. Concrete mix design.
   c. Availability and capacity of equipment to be used to transfer concrete to the tremie.
   d. The total volume of concrete to be placed.
   e. The various placement schemes available.
   f. Tremie locations.
   g. Maximum flow distance of concrete.
   h. Any restrictions to flow, such as reinforcing steel, piles, and internal form bracing.
1. The method of sealing the tremies and the emergency restart procedure if the seal is broken.
2. An inspection plan detailing sounding locations and the frequency of soundings.
   Take soundings over the entire placement area on, at least, an hourly basis.
3. A concrete sampling and testing plan.

2. Water Under 2 feet Deep. If placing concrete in water 2 feet deep or less, build the concrete above the water level in one end of the form, then place the concrete on top of the concrete above water, and gradually work ahead so that the smallest possible area of fresh concrete is exposed to the water.

3. Water Over 2 feet Deep. If concrete is placed in water deeper than 2 feet, place in approximately horizontal layers, in a consolidated mass in its final position, using the tremie method or other acceptable method, and do not disturb after placing. Do not place concrete with bottom-dump buckets. Use tight forms, constructed to retain concrete under water, and maintain still water within the forms. Regulate the consistency of the concrete to prevent segregation of the material. Before placing tremie concrete, ensure the foundation area is level, and all forms and surfaces are free of mud and silt. Use a tremie with a smooth interior face; and watertight discharge tube at least 10 inches in diameter, long enough to reach the bottom of the placement, and marked in 1-foot increments. Provide a valve or similar device, including various types of plugs, at the lower end of the discharge tube that closes tightly while the tremie is being charged and lowered into position, and that can be fully opened in the lowered position. Attach tremie tube to a funnel or hopper of at least 1/2-cubic yard capacity to facilitate transfer of concrete to the tremie. Do not use tremie tubes fabricated from aluminum. Furnish at least two tremie tubes to ensure continuous concrete placement. Do not place tremie concrete by pumping directly to the bottom of placement. Place tremie concrete only in the presence of the Project Manager. Maneuver the tremie tube by using an accurately controlled crane or hoist that allows free vertical movement of the discharge end of the tube. Keep the concrete level in the tremie tube stable. Maintain the equilibrium level. Keep the discharge end of the tremie tube fully submerged in the freshly deposited concrete. Keep the tremie tube relatively motionless. Do not move the tremie laterally during concrete placement. Place tremie concrete in one continuous operation. Place concrete at a rate that prevents aggregate segregation and allows flow over the entire placement area. Keep the top surface of concrete as level as possible. Maintain balanced hydrostatic pressures to prevent form failure and movement of water through the plastic concrete. When the tremie concrete has reached a minimum compressive strength of 2,000 pounds per square inch, proceed with dewatering of forms. Upon completion of dewatering, and in the presence of the Project Manager, thoroughly inspect the hardened tremie concrete. Remove laitance and other undesirable material by chipping, scraping, or other means that are not detrimental to the sound concrete. Visually inspect tremie slabs 3 feet or less in thickness, and if any areas of the concrete are suspect, drill cores as directed. For slabs greater than 3 feet in thickness, verify concrete integrity by drilling four 2-inch diameter cores, or one 2-inch core for every 100 square feet of slab area, whichever is greater. Drill additional cores as directed. Use a double tube core barrel with a diamond bit to obtain the cores. Do not exceed 5 feet for individual core runs. Drill cores from the top of the tremie slab to within 12 inches of the bottom. Operate drilling equipment at speeds and pressures that ensure satisfactory core recovery. Pull the core at the end of each run. Identify and store to preserve the integrity of the cores. Record the existence of any void areas or other concrete deficiencies. If defective concrete areas or voids are found, fill with pressure grout or Class A cement concrete as directed. Completely fill all core
holes as specified in 1001.3(k)11. Upon completion of the project, dispose of cores in a satisfactory manner.

D. Pumping Concrete.
1. Concrete Pump and Reduction Device. Provide a concrete pump with a flexible end section at least 10 feet long equipped with a reduction device or combination of devices to provide a steady and continuous discharge. Devices that may be used include, but are not limited to, a combination of 90 degree angles, a tapered reduction hose, a slide gate, a 6-foot diameter loop in rubber hose, or a finger reducer. Pump and waste enough material through the pump to insure that the grout used to prime the pump has been discharged from the system.

2. Determining QC and Acceptance Testing Location. The location of the QC sampling and acceptance sampling will be determined daily on the first load of concrete and for every 200 cubic yard thereafter, by the following procedure:
   a. Provide a concrete mixture in conformance with specification requirements in PennDOT Publication 408, Section 704 for slump, air content, and temperature before placement into the pump.
   b. Obtain a sample of concrete before placement in the pump and perform slump and air content tests.
   c. Position the pump into the most severe vertical drop boom configuration, or, when pumping from the same elevation as the placement, at the longest horizontal section configuration that will occur during placement.
   d. Obtain a sample of concrete at the discharge end of the pump and perform slump and air content tests.
   e. The entrained air in the hardened concrete must be between 3.5% and 7.5% as specified in PennDOT Publication 408, Section 704.1(c)3. If the test results for slump and air content taken at the discharge end of the pump are within ± 1.0 inch of the slump and ± 1.0% of the air content taken before placement into the pump, QC and acceptance testing may be performed before placement into the pump. If the test results are not within these tolerances, acceptance testing will be performed at the discharge end of the pump. The Project Manager may require acceptance testing and QC testing to be performed at the point of placement at any time the quality of the material comes into question. If more than one pump is utilized during a placement, each pump must comply with the above procedure.

E. Superstructures. When constructing superstructures, place the concrete in one continuous operation, unless otherwise indicated, specified, or directed. Before constructing spandrel walls, barriers, or other concrete construction placed on concrete slab, T-beam, rigid frame superstructures, or open or closed spandrel arches, relieve the supporting centering of falsework to allow the superstructures to take part of the permanent deflection. Do not place barriers for concrete rigid frame structures until after completing the backfilling and the embankment adjacent to the structures.

F. Bridge Decks. Contractor must submit proposed deck pour sequence, schedule, and details of temporary supports to ensure stability during construction, for review and approval. At least 2 weeks before concrete deck placement, schedule a deck preplacement meeting to review the specification, method and sequence of placing deck concrete, quality control testing, and method of protective measures, to control the concrete evaporation rate. Place concrete at a concrete temperature of between 50F and 80F. Provide the necessary equipment and determine the evaporation rate before starting deck placement and every hour during the placement. Do not exceed an evaporation rate of 0.15 pounds per square foot per hour. The allowable Evaporation Rate for exposed finished concrete is determined by ACI 305R-91, Figure 2.1.5 Have readily available at the bridge deck placement site, all
remediation equipment and procedures as submitted and approved at the deck preplacement meeting before starting the placement. If the value is exceeded, stop concrete placement until protective measures are taken to reduce the values to an acceptable level. Fog cure misting is an acceptable method to mitigate an excessive evaporation rate. Use high pressure equipment that generates at least 1,204 pounds per square inch at 2.19 gallons per minute, or with low pressure equipment having nozzles capable of supplying a maximum flow rate of 1.66 gallons per minute. Use nozzles that atomize droplets and can keep a large surface damp without causing water deposits. Apply the fog over the entire placement that is not covered by wet burlap. Do not leave concrete exposed for extended duration. Place concrete 5 feet to 8 feet ahead of finishing machine to prevent any premature concrete drying.

For rigid frame decks, place the concrete from the center of the span toward each leg or abutment simultaneously. Continuously check falsework or supporting beams so the concrete, as placed, meets the lines and grades indicated. Keep wedges and blocking tight during placement of the concrete.

Use a placing sequence for continuous spans, as indicated.

Unless allowed in writing by SEPTA, do not allow truck mixers, truck agitators, or other heavy motorized equipment on the deck spans in which concrete is being placed.

If it is necessary to stop operations, due to weather or operational conditions, provide bulkheads at the work site, and place them as directed. Remove bulkheads before resuming concrete placement operations.

Obtain acceptance of changes or additions to indicated construction joints, before incorporating into the work.

Use motorized, mechanical finishing equipment. Submit a sketch to the Inspector-in-Charge, describing the equipment and showing complete details of supports for the equipment.

Adjust the deck openings at expansion joints and at expansion dams at the time concrete is placed to provide the openings indicated at 68F under full dead load.

Vibrating screeds may be used, with the written permission of SEPTA. Vibrating screeds are to be power-vibrated and moved by means of a positive, power-operated apparatus, but are not to be a substitute for high-frequency vibrators. Hand-finishing methods will be allowed outside mechanically screeded areas and to a placed bulkhead in cases of power equipment failures.

Use strike-off finishing machines or screeds large enough to finish the full width of deck between curbs or between longitudinal construction joints, or between both.

When strike-off finishing machines are used, support the wheels above the pavement surface on temporary rails, supported on non-deflecting forms or other horizontal structural devices. Support vibrating screeds on temporary pipe guides or on-grade angles. Use adjustable finishing machine supports or vertical supports for screed guides. Fix supports during finishing, at intervals to limit deflection to not more than 1/8 inch in 10 feet. Use supports that are removable to at least 2 inches below the surface with a minimum disturbance of concrete. Fill voids left upon removal of screed guides and supports with nonstaining, nonshrinking mortar, after the deck concrete has reached its initial set.

Do not allow screed or runway supports to bear on the forms, unless direct undersupport is provided to prevent form damage or deflection. Do not discharge concrete near side laps or at midspan of the corrugated sheets, to a depth greater than 10 inches above the top of the forms. Do not discharge concrete in a manner that causes excessive concentrated construction loads.
Place concrete, at a minimum rate of 20 linear feet of deck per hour, in a longitudinal direction, except for reinforced concrete slabs and rigid frames.

Vibrate the concrete to prevent honeycombing and voids, especially at construction joints, expansion joints, valleys, and ends of form sheets. Obtain acceptance of placing sequences, procedures, and mixes before placing concrete.

Repair or replace damaged material.

Conduct final finishing operations immediately behind the finishing machines or screeds from work bridges of rigid construction, not in contact with the surface of the concrete, set on rails, and easily moved. Finish with a 10-foot, long-handled straightedge to achieve a smooth surface. Make one pass of the float if after the finishing machine operations the concrete surface remains open. Do not overfinish. Fog misting equipment is allowed on the finishing machine to maintain the evaporation rate below the allowable value.

Perform straightedge testing and surface correction as specified in PennDOT Publication 408, Section 501.3(k)3 while the concrete is workable. After completing the straightedge testing and surface corrections, before the concrete becomes nonplastic, texture the surface as specified in PennDOT Publication 408, Section 501.3(k)4. Immediately after texturing operations are completed, perform intermediate curing as per PennDOT Publication 408, Section 1001.3(p) 3.c. Cure the deck as specified in PennDOT Publication 408, Section 1001.3(p)3.b for a minimum of 14 days. Maintain wet burlap application within 10 feet to 18 feet behind the finishing equipment at all times. Minimal marking of the concrete is allowed. Following cure, test the surface again, as specified in PennDOT Publication 408, Section 501.3(o).

For bridge decks placed between September 1 and March 1, apply a penetrating sealer as specified in PennDOT Publication 408, Section 1019.3(c) 2.

If directed to facilitate inspection, remove at least one section of permanent forms, at a location directed, for each span of every bridge in the project. After the deck concrete has been in place for a minimum period of 2 days, test the concrete by sounding with a hammer, where directed. If hollow sounding areas are found, and if directed, remove the forms for the Project Manager's inspection after the concrete has attained adequate strength. The forms need not be replaced. Repair the adjacent metal forms and supports in order to present a neat appearance. Remove or repair unsatisfactory concrete. Provide facilities for the safe and convenient conduct of the inspection.

Once the concrete deck is cured, the top flange of the girders must be continuously supported.

G. Reinforced Concrete Arches. Place the concrete symmetrically on each side of the span and progress uniformly from the spring line to the crown.

H. Reinforced Concrete Box Culverts. Place concrete in the base slab with horizontal construction joints formed in the sidewalls as indicated. Form horizontal construction joints to provide keys, as shown on the Standard Drawings. When the concrete has reached the top of the sidewall, stop the concrete operation for 2 hours to allow for settlement of the wall concrete before placing the top slab.

I. Bearing Areas of Substructures. As indicated, construct concrete bearing areas of substructures upon which neoprene pads, masonry plates, shoes, pedestals, column bases, or other metallic bearing devices are to be placed. Slope areas between and surrounding bearings to drain so no water accumulates or stands at any point. After curing, grind the defined bearing area to the indicated elevations, as necessary, according to the following tolerances:
1. Deviation from specified elevations:
   a. For steel beam superstructures, ±0.01 feet, except do not exceed a 0.01 feet difference between specified elevations of bearing areas of adjacent beams measured at the centerline of beams and centerline of bearings.
   b. For prestressed concrete beam superstructures, ±0.02 feet

2. Having no projecting irregularities exceeding 1/16 inch

3. Variation in flatness:
   a. For neoprene pads, ±1/16 inch
   b. For metal bearings and high load multi-rotational bearings:
      1) Bearing seats up to 30 inches long, ±1/16 inch
      2) Bearing seats over 30 inches but less than 45 inches long, ±3/32 inch
      3) Bearing seats over 45 inches long, ±1/8 inch
   c. Variation in slope between specified elevations for each beam seat:
      1) For neoprene pads, 300:1
      2) For metal bearing and high load multi-rotational bearings, 200:1

When using neoprene pads, provide a bearing surface with a rough texture.

For metal and high-load multi-rotational bearings, fill minor depressions caused by finishing, bush hammering, or grinding with a low-viscosity epoxy applied with a squeegee.

J. Patching. Saturate holes with water and, immediately, completely fill the holes with nonstaining, nonshrinking mortar. For holes passing entirely through walls, use a plungertype caulking gun or other device to force the mortar through the wall starting at the back face. Hold a piece of burlap or canvas over the hole on the front face. Then, when the hole is completely filled, strike off the excess mortar until the mortar is flush with the surface. Completely fill holes not passing entirely through the wall by ramming the mortar in place with a suitable tool. Strike off the excess material until the material is flush with the wall surface.

For minor patching, treat concrete surfaces to be patched with a paint coat mixture of neat cement and water. Tamp mortar into place manually, preferably to at least 1/2 inch depth. When possible, overfill spaces being repaired. Allow the excess to stand for 5 minutes, then strike off and finish without excess troweling. Where the space cannot be overfilled, finish immediately. Cure for at least 3 days using an acceptable method that ensures against loss of moisture by evaporation. When required for all or part of the curing period, hold the mortar in place or support by using an acceptable method that ensures retention of the mortar without its drying out.

K. Concrete Bridge Barriers.

1. General. For bridges with spans of 20 feet or more, construct barrier as indicated and as shown on the Standard Drawings, using conventional fixed forms. Conform to the following finished tolerances for conventional fixed-form methods of bridge barrier construction:
   a. Bar Reinforcement Cover ±1/4 inch
   b. Width (Top) ±1/4 inch
   c. Width (Bottom) ±1/4 inch
   d. Surface Straightness (Deviation from centerline of individual section of unit) 1/4 inch in 10 feet
   e. Vertical Profile Alignment (Deviation from a line parallel to the grade line) 1/4 inch in 10 feet
   f. Alignment with Edge of Bridge Deck 1/4 inch in 10 feet

Test surface straightness and vertical alignment along the front face, top, and rear face of the barrier using a 10-foot straightedge. Hold the straightedge in successive
positions for the entire length of the barrier and advance in stages of not more than 5 feet.

3.06 CONCRETE FINISHING

A. Final Finishes.
   1. Conventional Finish. Do not brush or bag finish, or paint with grout or neat cement. After the forms are removed, correct irregularities in the exposed concrete surfaces. Exposed surfaces are surfaces above normal ground level or water level, when applicable, and surfaces that will not be concealed by other construction. Irregularities include fins, protrusions, individual holes larger than 1 inch in any dimension, and clusters of smaller holes.
   2. Tooled Finish. Tool finish surfaces as indicated by cutting into the body of the concrete with a pointed tool or bush hammer until the concrete surface shows a grouping of broken aggregate particles in a matrix of mortar.
   3. Other Finishes. Finish surfaces by other methods as indicated.

3.07 CURING AND PROTECTION

A. Curing and Protection of Concrete. Begin curing as soon as the concrete has been placed and is sufficiently hardened. Cure concrete as specified in Section 3.07.B.4. Do not count as a curing day, a day on which the curing temperature drops below 50F at any time during that day, except for flood curing of footings. For bridge decks, during day 1 through day 7, do not count as a curing day, a day on which the curing temperature drops below 50F. During day 8 through day 14, do not count as a curing day, a day on which the curing temperature drops below 40F. If at any time during the curing period, the curing temperature falls below 35F, the Department will consider the work unsatisfactory and will reject it.

B. Definitions of Temperatures.
   1. Air Temperature. PennDOT Publication 408, Section 101.03
   2. Curing Temperature. Curing temperature is the temperature of the air immediately adjacent to concrete. Where concrete is not covered by forms or other protective coverings, or where protective coverings are considered inadequate, the curing temperature will be the air temperature. During cool and cold weather, the curing temperature is the temperature inside the forms, protective coverings, or housings specified in PennDOT Publication 408, Section 1001.3(p)5. The curing temperature for the first 24-hour period after placing concrete will be considered as not more than the temperature of the concrete at the time of its placement in the forms.
   3. Records of Temperature. Provide high-low thermometers to maintain an accurate daily record of air and curing temperatures during cool and cold weather. In the presence of an Inspector, take curing temperatures on the surface of the concrete, at representative locations on a structure. Submit these temperature records daily to the Inspector-in-Charge.
      a. Water Curing. Use a fog-spray, perforated pipe or hose watering system to keep forms and curing covers saturated during the curing period. For curing and protecting covers on endwalls, inlets, manholes, copings, bridge seats, and similar miscellaneous concrete, keep saturated using an acceptable method. Flood curing of concrete footings will be allowed if the water temperature is 40F or above.
         1) Use covers of either burlap-backed, white polyethylene sheeting, or a double thickness of burlap. For bridge decks, use only a double
thickness of burlap. Use one type of cover for the duration of curing, unless a change in type is accepted. Place covers without marring the finished surface. Secure covers to prevent their being lifted and displaced.

2) Saturate the covers prior to use and keep in a saturated condition for the curing period. Cure for a minimum of 7 days; cure bridge decks for a minimum of 14 days; when High Early-Strength concrete is used, cure for a minimum of 3 days. Cure for at least the minimum time stated above and until minimum compressive strengths are attained, as specified in PennDOT Publication 408, Section 704.1(d)4.b, as determined from molded cylinder specimens tested according to PTM No. 604.

3) As soon as the concrete has hardened sufficiently, place curing covers on the exposed concrete. If the double thickness of burlap method is used, place burlap so each strip overlaps one-half its width.

4) As soon as forms or sections of forms are loosened or removed, cover the exposed concrete surfaces with pre-saturated curing covers, then keep saturated for the remainder of the curing period.

b. Bridge Deck Intermediate Curing. Apply an intermediate monomolecular film curing agent to all concrete bridge decks. If directed, apply additional applications to prevent surface drying before placement of curing covers.

1) Apply the monomolecular film in a light-fog application, using a pressure spray tank with an adjustable nozzle. Use a water-to-curing agent ratio and rate of application, both according to the manufacturer’s recommendations. Agitate the solution before each application.

2) Apply the monomolecular film in a continuous film, immediately after the final finishing operation is completed on any area. Do not perform finishing after application of the curing agent.

3) After application of the monomolecular film, complete curing using water.

5. Cool Weather Curing and Protection. If the forecasted air temperature during concrete curing is expected to drop to 50F but not below 35F, or if concrete is placed at an air temperature below 50F but above 35F, follow the requirements for normal curing and protection. In addition, cover burlap with polyethylene sheeting; and place insulating mats, as specified in PennDOT Publication 408, Section 711.1(e), or place hay or straw, to a depth of at least 12 inches, over concrete not covered by forms. Keep the insulation mats, hay, or straw in place as required to maintain proper curing temperatures.

a. Cold Weather Curing and Protection. If the forecasted air temperature is expected to drop to 35F or lower, during concrete curing, or if concrete is to be placed at air temperatures below 35F, comply with the requirements specified for normal curing and protection, and use heating and/or insulation, as necessary, to maintain the curing temperature for the duration of the curing period. If forms are removed before the end of the curing period, provide additional heating or insulation, as necessary, to maintain the curing temperature for the remainder of the curing period. After the concrete has cured for the required length of time, gradually lower its temperature to that of the surrounding air. Do not allow the temperature of the concrete to drop more than 20F in any 24-hour period for the first 3 days after the curing period. Continue to record the air temperature and curing temperature during this 3-day period.

1) Heating. Furnish and place sufficient canvas and frames, or another type of housing to enclose and protect the fresh concrete and forms. Before
placing the concrete, furnish necessary fuel and sufficient acceptable heating apparatus; preferably steam-heating equipment.

a) Keep the air surrounding the fresh concrete at a temperature above 50F but not more than 80F. Keep the concrete covers moist during the curing period.

2) Insulating Mats or Foam Insulation. Insulating mats or foam insulation, as specified in PennDOT Publication 408, Section 711.1(e) and PennDOT Publication 408, Section 711.1(f), respectively, may be used to maintain curing temperature.

a) Apply the mat insulation tightly against the forms. Seal the ends of the mat to exclude air and moisture. Overlap the insulation on previously placed concrete by 1 foot.

b) When using steel forms, place the insulation tightly against the forms. In addition, insulate the framework of the steel forms, either by the use of the insulating mat material or foam insulation, or by draping polyethylene sheets or tarpaulins over the exposed members, to effectively reduce the heat loss.

c) Immediately repair tears in the mat liner. Where tie rods extend through the insulated form, place close-fitting washers on the rod against the mat and secure, to provide adequate protection.

d) Cover the tops of piers, abutments, and similar concrete surfaces with the insulation mat, tightly secured to prevent loss of heat.

e) For the areas around protruding reinforcement that cannot be protected with the insulation mat, cover with a double thickness of burlap. Cover with enough straw or hay to prevent loss of heat from the concrete during the curing period. In addition, cover insulated areas with tarpaulins.

f) Do not insulate bridge decks unless the underside is enclosed and preheated before the concrete is placed and the heat is maintained at the specified temperature during the entire curing period.

g) When foam insulation is used, use a minimum thickness of 1 1/2 inches. The Contractor may use cracked molded foam boards only after repairs are made with an adhesive.

h) Keep the insulation protection in place for the full curing period, but do not allow the concrete temperature to rise above 160F.

i) Do not expose fresh concrete to subfreezing temperatures. Provide standby heat, if directed. Failure to properly place the insulation material or failure to maintain the necessary concrete temperature will be cause for the Project Manager to deny continued use of the material on the project, for curing in cold weather, and require the use of heating, as specified in PennDOT Publication 408, Section 1001.3(p)5.a.

3.08 RE-FORMED COMPRESSIBLE JOINT FILLER INSTALLATION

A. Not used.

3.09 JOINT SEALANT AND BACKER ROD INSTALLATION

A. Not used.
3.10 NON-SHRINK GROUT

A. Not used.

3.11 FIELD QUALITY CONTROL

A. Concrete Testing Services
   1. The Contractor is responsible to provide for all quality control of concrete and shall arrange for the testing with an independent testing laboratory or entity acceptable to the Project Manager.
   2. During the entire period of individual concrete placements, on-site testing services shall be provided by the approved Testing and Inspection Agency in accordance with the requirements specified in Section 01410. Do not place concrete without the on-site inspector from the Testing and Inspection Agency present.
   3. The Contractor shall provide access to the work and fully cooperate with the Testing and Inspection Agency in the performance of these tests.
   4. The Contractor shall provide concrete for sampling and testing as required by the Project Manager and the Testing and Inspection Agency.

B. Concrete Samples for Compression Testing
   1. Mold and cure six test specimens, in accordance with ASTM C31, for each 50 cu. yds. or part thereof, of concrete placed.
   2. Use standard 6-in. x 12-in. cylinders.
   3. Cylinders shall be laboratory cured except field cured cylinders will be permitted for structures that will be immediately subject to loading and where forms will be stripped within three (3) days.
   4. Perform compressive strength tests in accordance with ASTM C39. Test two specimens at 7 days for information and test two specimens at 28 days for acceptance. The two remaining specimens shall be retained for a possible additional testing until the results of the 28 day tests are known to be acceptable. If a high early strength mix is used, test two specimens at 3 days, two at 7 days and two at 28 days.
   5. When frequency of testing will provide fewer than five compressive strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   6. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.
   7. Compression strength test reports shall identify the test number, the mix design, the identity of the structure in which the concrete being tested was placed including, where applicable, the location within the structure, the sampling date, the test date, the slump and air entrainment test results and the compressive strength results.

C. Field Testing
   1. The Testing and Inspection Agency shall perform the following tests in accordance with the requirements of the applicable ASTM Standards cited in this Section:
      a. Sampling Fresh Concrete: Project Manager samples of fresh concrete shall be obtained according to ASTM C172, except modified for slump to comply with ASTM C94.
      b. Slump: Perform field tests in accordance with ASTM C143 for each compressive strength test and as a minimum whenever consistency of the concrete appears to vary. Conduct one test at point of placement for each concrete truck delivery. Slump testing is to be performed prior to concrete
placement. Addition of water to the concrete mix is not permitted after slump
test.

c. Air Content: Perform air content tests in accordance with ASTM C231 or C173
at the same frequency as the slump tests. One test for each compressive
strength test, but not less than one test for each day's placement of each type
of air-entrained concrete.

d. Concrete temperature: ASTM C1064; one test hourly when air temperature is
40°F and below and when 80°F and above, and one test for each set of
compressive strength specimens.

D. Field Inspection: The Testing and Inspection Agency and the Contractor shall inspect the
formwork and reinforcement for conformance with the approved Shop Drawings and
Contract Documents and must sign-off on a "Concrete Placement - Quality Assurance" form,
a sample of which is attached at the end of this Section, prior to placement of concrete. The
Contractor will also be required to sign off on the form before concrete placement.

E. Pachometer Testing: Evaluate the concrete cover on the top layer of the bridge deck
reinforcing steel by following the procedure outlined in PA Test Method No. 419, "Depth of
Steel Embedded in Concrete Bridge Decks Using the Pachometer Method", dated June
2003. Perform testing within two weeks after the completion of the deck concrete curing
period, in the presence of the Inspector-in-Charge.

F. Identification: The Testing and Inspection Agency shall identify each test by project name,
conge-se manufacturer, name of Laboratory, type or class of concrete, specimen
identification number, mix, amount of admixture, origin of sample in the project, the date test
specimen was made, the date test specimen was tested, the amount of slump determined,
the compressive strength test results and type of break for 7 and 28 days.

G. Reports
1. The Testing and Inspection Agency shall prepare and submit all reports required in
the various standards and specifications referenced.
   a. Distribution of reports shall be:
      1) Two (2) copies to the Project Manager.
      2) One or more copies, as required, to the Contractor.

2. The distribution of all copies shall be indicated on all copies.
3. For additional requirements, refer to Section 01400.

H. The Testing and Inspection Agency shall immediately notify the Contractor and the Project
Manager of any test results that do not conform to Contract requirements.

I. Additional Testing
1. The testing laboratory shall make additional tests of concrete when test results
indicate slump, air entrainment, concrete strengths, or other requirements have not
been met, as directed by SEPTA. The Testing Laboratory may conduct tests to
determine adequacy of concrete by cored cylinders complying with ASTM C42, or by
other methods as directed by the Project Manager.
   a. The Contractor shall bear the cost of additional tests when strength tests have
failed to meet the specified acceptance criteria.

J. Non-conforming Work
1. Concrete surfaces that develop shrinkage cracks greater than 0.01" (10 mils) wide;
devolop a large frequency of cracking within 28 days after installation; exhibit
honeycombing, exposed aggregate, uneven surfaces, protruding form ties and other
such surface defects shall be considered defective and shall be classified as non-
conforming work.
2. Repair or replace non-conforming concrete work as directed by the Project Manager and at no additional cost to SEPTA.

3. Patch defective concrete surfaces with a suitable, approved patching material, mix or product as directed by the Project Manager.

### 3.12 FORMS AND CENTERING.

A. General. Support forms so that deflection does not exceed 1/2 inch under plastic concrete. Before using forms, clean them and obtain approval for use. Use forms that are strong and firm; securely braced; tied together, if required, by means of form ties, tight enough to prevent the leakage of mortar; and strong enough to withstand the action of mechanical vibrators, if used.


2. Adequately brace forms. If forms are insufficiently braced or unsatisfactorily built, the work will be halted, either before or during concrete placement, until such defects have been satisfactorily corrected. Chamfer the edges as indicated. Do not leave wood separators in the completed work.

3. Do not use form support systems that will cause unacceptable overstress or deformation to permanent bridge members.

4. Use ties that are adjustable in length, to allow tightening of forms. Use ties that leave no metal in the concrete within 1 1/2 inches of the exposed surface. Do not fit ties with lugs, cones, washers, or other devices to act as spreaders within the form, or devices that leave depressions in back of the exposed surface of the concrete. Flat bands may be used, if the bands conform to the following:
   a. Not less than 3/4 inch wide.
   b. Not less than 14 gage thick.
   c. Placed on edge.
   d. Protected by adequate spreaders to prevent twisting during construction.

5. Do not use wire ties or thin, narrow, flat bands, except in the construction of endwalls, inlets, and manholes. Where necessary, coat the form ties with a release agent to facilitate removal. Do not damage the concrete on the exposed surface when removing forms and ties. Do not cut ties back from the concrete face.

6. Before starting construction, obtain acceptance of working drawings required for centering and falsework, as specified in PennDOT Publication 408, Section 105.02(c). Before placing concrete, obtain acceptance of in-place forms. Camber the centering to compensate for dead-load deflection and settlement of centering. Provide for gradual and uniform lowering.

7. Where required, drench the inside of forms with water immediately before placing concrete.

B. Metal Bridge Deck Forms (Permanent). When portions of a bridge deck are constructed adjacent to each other and divided by an open or a preformed joint, do not use metal forms in the cantilever area on either side of the joint, except with prior written permission of the Chief Bridge Engineer.

1. Submit shop drawings of the forms as specified in PennDOT Publication 408, Section 105.02(d) for review and acceptance. Include the following on the shop drawings:
   a. Grade of steel.
   b. Physical and section properties for permanent metal bridge deck form sheets.
   c. Methods of attachment.
d. Locations where the forms are supported by steel beam flanges, subject to tensile stresses. Prepare the drawings, conforming to the details and design shown on the Standard Drawings.

2. Before welding in a tension zone, make a test installation on a sample of a simulated flange, using the same welding procedure, materials, and fit-up that are to be used in the tension zone. Allow no burn-through of the parts being welded or fusion to the flange. Do not weld to flanges in tension zones. When this welding procedure has been satisfactorily demonstrated, do not deviate from that used in the test during welding in the tension zone.

3. Perform field cutting of forms, supports, and closures using saws, shears, or other acceptable methods. Do not cut by burning or melting. Make the attachments concrete tight. A fastening system, using a low-velocity, powder-actuated piston tool to attach forms to support angles, may be used. Thoroughly clean and wire brush form metal where galvanized coating has been damaged. Paint with two coats of Zinc Dust-Zinc Oxide Primer, no color added, according to Bulletin 26, or ASTM A 780. Areas of welds and of weld burns need not be touched up. Uncoated edges, resulting from shearing or punching, are acceptable.

3.13 REINFORCEMENT.

A. Reinforcement Bars. PennDOT Publication 408, Section 1002.3. For bridge decks, also comply with the following:

1. All reinforcement bars to be epoxy coated, no black or galvanized reinforcement permitted.

2. Place bars as indicated. Use reinforcement chairs, spaced not greater than 3 feet apart, to maintain the position of bottom and top bars. Tie down the top bar mat as specified in PennDOT Publication 408, Section 1002.3(d). Tie the top bar mat to the lower bar mat, forms or form straps, or studs or chairs tied to the lower mat, at sufficient locations to hold the reinforcement in the proper position. Provide beam haunch reinforcement as indicated and as shown on the Standard Drawings.

3. Use galvanized chairs with ASTM A 641, Class 3 coating, or use stainless steel, plastic-coated or epoxy-coated steel chairs. Use chairs with exposed cut-ends coated or turned up.

4. Place reinforcement so the indicated cover clearance does not deviate from joint position by more than ±1/4 inch.

5. Do not place concrete until the reinforcing placement is accepted.

B. Steel Welded Wire Fabric. Place as indicated. Lap ends and sides 12 inches. Fasten with annealed iron wire or metal clips.

3.14 WEEP HOLES.

A. Construct holes as indicated. Place geotextiles, Class 1, as specified in PennDOT Publication 408, Section 212.3. Then, place approximately 1/2 cubic yard of No. 57 coarse aggregate within the geotextiles at the inlet end, unless otherwise directed.

3.15 STRUCTURE FOUNDATION DRAINS.

A. Construct as indicated. Place within geotextiles, Class 1, as specified in PennDOT Publication 408, Section 212.3.
3.16 PIPES AND CONDUITS.
   A. Place pipes and conduits in the structure concrete as indicated, including pipes and conduits supplied by others. Maintain existing pipes and conduits, where indicated. If indicated, wrap pipes with bituminous paper.

3.17 PLACING ANCHOR BOLTS AND EXPANSION PLATES.
   A. Place expansion plates, anchor bolts, pier nosing angles, and other material as indicated. Place anchor bolts supplied by others as indicated or directed. Paint projecting portions of anchor bolts as specified in PennDOT Publication 408, Section 1060.3 as soon as practical after the anchor bolts have been set, but not until the surrounding concrete or grout has hardened sufficiently to preclude damage from the painting operation. Coat threads with grease after painting.
   B. If the bridge substructure and superstructure are built under separate contracts, proceed as specified in PennDOT Publication 408, Section 1050.3(c)4.g.

3.18 PLACING LIGHTING POLE ANCHORAGE.
   A. Construct the lighting pole anchorages as an integral part of the structure. Where indicated, install anchor bolts, nuts, and washers, as specified in PennDOT Publication 408, Section 1105.02(c)2, 1 1/4-inch conduit, junction box, drain pipe, steel angles, and the required fittings. Cap the conduit with a cap or plug to prevent entry of foreign material and moisture.
   B. For future lighting, protect the anchor bolts using a painted hardwood block.

3.19 CONNECTIONS OF EXISTING AND NEW CONCRETE.
   A. Terms. The terms “new concrete construction,” “fresh concrete,” and “hardened concrete” refer to work performed under the current contract. “Hardened concrete” has cured for a minimum of 28 days.
      1. The terms “existing concrete structures” and “existing concrete” refer to work performed under a previous contract.
   B. General. To connect fresh concrete with hardened or existing concrete, thoroughly clean the connecting surface of laitance and loose and foreign material prior to applying the Type II (in a non-load bearing joint) or Type V (in a load bearing joint) epoxy bonding compound as specified in PennDOT Publication 408, Section 706.
      1. Coat contact surfaces with concrete bonding compound at construction joints between fresh concrete and existing concrete. Coat contact surfaces with concrete bonding compounds to connect fresh concrete with hardened concrete at all deck construction joints, deck expansion joints, expansion dam block out areas, and where indicated, as specified in PennDOT Publication 408, Section 1040.3(e). Coat surfaces in accordance with the manufacturer’s recommendations. Use of other bonding compound coatings extends the period after coating between placement pours, but in no case longer than 24 hours (typical), or in accordance with the manufacturer’s recommended viability of the coating, whichever is less.
   C. Tied Connections. Where indicated, to connect new concrete construction to existing concrete structures, use drill holes of the required depth and diameter in the existing structure to allow placing dowel bars, expansion bolts, or extensions of reinforcement. Furnish and place in the holes, dowel bars, expansion bolts, and reinforcement of the size and type indicated. Grout studs, dowels, and anchor bolts with nonshrink grout or anchor as indicated.
3.20 REMOVAL OF FALSEWORK AND FORMS AND APPLICATION OF EXTERNAL LOADS TO CONCRETE.

A. Except for flood curing of concrete footings, do not count a day during which the curing temperature falls below 50°F in the total elapsed days required for removal of falsework or forms or for the application of external loads on concrete.

B. Removal of Falsework and Forms. Keep falsework and forms under arches, box culverts, pier caps, slabs, beams, girders, and brackets in place for 5 days after placing the final portion of the section involved, after which they may be removed provided the concrete has attained a minimum compressive strength as specified in Table A. Determine the minimum compressive strength according to PTM No. 604 or determine the minimum compressive strength by the maturity method according to PTM No. 640. Cure test cylinders according to PTM No. 611.

C. During normal and cool-weather curing, keep forms for walls, columns, outside faces of pier caps, arches, sides of beams, and other vertical faces not sustaining loads, in place for a minimum of 12 hours after completing placement of concrete. Then, remove forms, provided the concrete has hardened enough to preclude damage resulting from form removal. Barrier forms may be removed in less than 12 hours, provided the concrete has hardened enough to preclude damage from form removal. During cold-weather curing, keep forms in place for a minimum of 5 days.

D. At construction joints, keep bulkheads in place for a minimum of 12 hours after placing concrete. Then, remove bulkheads provided the concrete has hardened enough to preclude damage resulting from removal of the bulkheads. During cold weather curing, keep bulkheads in place for 48 hours, and keep the concrete moist at all times.

| Table A |
| Minimum Compressive Strength |
| Minimum psi |
| Class P | 4,500 |
| Class AAAP | 3,000 |
| Class AAA | 3,300 |
| Class AA | 2,750 |
| Class A | 2,500 |

E. Application of External Loads to Concrete. Strength determination for all values given in PennDOT Publication 408, Section 1001.3(q)2 will be determined by compressive strength according to PTM No. 604 or maturity method according to PTM No. 640.

1. Dead Loads. Do not begin work on wall, column, or pier shaft construction until 12 hours after placing footings. For footings on piles, do not begin work until 48 hours after placing footings. Where falsework for the cap on pier bents is supported on the footings or from the ground, do not begin work on the cap construction until 24 hours after placing the columns. Where forms are supported on collars attached to the columns, do not begin work on cap construction until 5 days after placing the columns, and the concrete has attained its minimum compressive strength, as specified in Table A. Construct column- and pier-shaft lifts according to one of the following methods:

   a. Method 1. Where the forms for previous lifts, not including the footing, are left in place and adequately braced, do not place the next higher lift until 24 hours after placing the lift immediately below.
b. Method 2. Where forms are supported by the concrete in the previous lift, not including the footing, and where other forms and bracing have been removed from the lower lifts, do not place the next higher lift until 5 days after placing the previous lift, and the concrete has attained its minimum compressive strength, as specified in Table A.

Do not place superstructure beams on abutment walls, or solid shaft piers until 3 days after placing the wall or shaft, and the concrete has attained its minimum compressive strength, as specified in Table A.

Do not place superstructure beams on caps, pier bents, or on cantilevers of hammerhead piers until 5 days after placing the caps or cantilevers, and the concrete has attained its minimum compressive strength, as specified in Table A.

2. Backfilling. Backfill as specified in PennDOT Publication 408, Section 206. Do not backfill or place material adjoining abutment walls, backwalls, retaining walls, box culverts, and arches until 7 days after placing last concrete, and then only if concrete has attained the 7-day Minimum Mix Design Compressive Strength as specified in PennDOT Publication 408, Section 704, Table A. Maintain symmetrical loading on each side of the span, and progress uniformly in placing embankment and structure backfill adjacent to, and over, arch rings, box culverts, or rigid frame structures, unless otherwise indicated.

3. Live Loads. Do not allow live loads on a bridge span or continuous unit during placement of any deck, sidewalk, and barrier concrete on that span or continuous unit. Do not allow truck mixers, truck agitators, other heavy equipment, construction traffic, or the traveling public on a structure until authorized by the Project Manager. This authorization will be based on the following restrictions:

a. Do not allow live loads on the bridge deck until a period of 14 days has passed after placing the last deck and sidewalk concrete and the deck and sidewalk concrete has attained a minimum compressive strength of 4,000 pounds per square inch.

b. Do not allow live loads on the bridge deck until a period of 7 days has passed after placing the last barrier concrete and the barrier concrete has attained a minimum compressive strength of 3,000 pounds per square inch.

c. Do not construct sidewalk on new decks until 7 days after placing the deck concrete and the deck concrete has attained a minimum compressive strength of 3,250 pounds per square inch.

d. Do not construct barrier on new sidewalks until 7 days after placing the sidewalk concrete and the sidewalk concrete has attained a minimum compressive strength of 3,250 pounds per square inch.

Do not allow trucks or heavy equipment to travel within 12 feet of barrier until 7 days after placing the barrier concrete and the barrier concrete has attained a minimum compressive strength of 3,000 pounds per square inch. Control speed of trucks, equipment, and the traveling public until barriers have attained a minimum compressive strength of 3,500 pounds per square inch.

3.21 WATERPROOFING.

A. Apply waterproofing as indicated or where directed, as specified in PennDOT Publication 408, Section 680.3 and as follows:

B. Cracks in Culverts. Where directed, cover minor cracks in culverts by waterproofing them with an accepted sealer. Apply the sealer as recommended by the sealant manufacturer. Seal cracks on backfill sides only.

C. Form Tie Holes. If directed, satisfactorily waterproof form tie holes on the backfill side of the box or arch culverts.
3.22 DEFECTIVE WORK.
   A. Remove and replace concrete that is bulged, uneven, or that shows honeycombing or marks
      that cannot be satisfactorily repaired. If directed, remove and replace concrete that has not
      attained the minimum compressive strength.

3.23 BRIDGE APPROACH SLABS.
   A. Construct as shown on the Contract Drawings and in accordance with PennDOT Publication
      408, Section 505.3.
CONCRETE PLACEMENT – QUALITY ASSURANCE  
(SAMPLE)

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<th>ITEM</th>
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<th>Inspector</th>
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<td>Reinforcing steel</td>
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<td>Final clean-up</td>
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END OF SECTION 03300
SECTION 03500
EPOXY INJECTION CRACK SEAL

PART 1 – GENERAL

1.01 DESCRIPTION
A. This work is the construction of a protective barrier on bridges over electrified railroads.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 - General Requirements

1.03 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications
      b. Bulletin 15, Approved Construction Materials

PART 2 – PRODUCTS

2.01 EPOXY RESIN SYSTEM
A. Provide a system conforming to the strength requirements of ASTM C 881, Type I, Grade 1, PennDOT Publication 408, Specifications, Section 706.1, for epoxy injection and from a manufacturer listed in PennDOT Bulletin 15.

2.02 SURFACE SEAL
A. Provide a surface seal as recommended by the manufacturer and of adequate strength to hold injection fittings firmly in place and to resist injection pressures adequately to prevent leakage during injection.

2.03 INJECTION FITTINGS
A. As recommended by the manufacturer.

2.04 CERTIFICATION
A. See, PennDOT Publication 408, Specifications, Section 106.03(b)3.

PART 3 – EXECUTION

3.01 CONSTRUCTION
A. Preliminary Work: SEPTA will mark areas to be sealed.
B. Preparation for Sealing: Thoroughly clean the surfaces of rust, scale, grease, loose and disintegrated particles, and material. Remove unsound concrete and mortar as directed. Glue injection ports in place at spacings as recommended by the manufacturer. Bevel cracks, as directed, to facilitate installation of injection ports. Seal the surface and areas surrounding the entry ports with surface seal. Apply seal so that the epoxy injection resin is sealed until initially cured.

C. Mixing Epoxy Resin System: Mix the epoxy resin system according to the manufacturer's instructions with a minimum 180 second mixing time using a low speed (400 rpm to 600 rpm) electric drill with an approved mixing paddle. The mixing may also be accomplished by an injection machine capable of metering and mixing the specific proportions of components within a tolerance of ± 5%.

D. Injection Procedure: Do not inject the cracked area until after the surface sealer has hardened. Inject the epoxy with a hand held gun, pressure pot, or injection machine or as recommended by the manufacturer. Start injection at the lowest point on the crack. When the material begins to flow from the next higher entry port, remove the nozzle, plug the port, and insert the nozzle in the next higher entry port. Continue the operation until the crack is completely filled. After the epoxy material has achieved an initial cure, remove the entry ports and, if necessary, patch the areas with the same material used to seal the rest of the crack surface.

E. Application Limitations: Do not apply or inject epoxy materials if the ambient or concrete temperature is below 50 °F.

END OF SECTION 03500
SECTION 03600
CONCRETE REHABILITATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work in this Section consists of furnishing all labor, materials, equipment, tools and other incidents necessary to remove, repair and restore existing damaged concrete surfaces as directed by the Project Manager, as specified herein and as required for a complete and proper rehabilitation.

B. Specific concrete surfaces to be restored include concrete slabs, abutments and wingwalls, bridge seats, retaining walls and ballast curbs.

C. Types of concrete repairs to be made include but are not limited to:
   1. Repair of spalls and delaminations in existing concrete surfaces.
   2. Repair of cracks in existing concrete surfaces.
   3. Repair of construction joints and expansion joints.

D. The concrete rehabilitation work specified herein is applicable to existing structural concrete elements that are to remain and become incorporated in the rehabilitated bridge.

E. The location and extent of concrete rehabilitation work depicted on the Contract Drawings is based on limited field surveys and is intended to be an approximate representation of the concrete rehabilitation work required. The concrete rehabilitation work shown should only be used by prospective bidders as a guideline in determining the general nature and scope of the repair work. The actual extent of the repair work will be determined on the basis of field inspections conducted jointly by the Contractor and the Project Manager or designated representative during construction.

F. This Section includes, but is not limited to, the following items:
   1. Concrete Spall Repairs
      a. Shallow Spall Repairs – Maximum 2 inches in depth.
   2. Structural Crack Repairs
      a. Concrete cracks using the epoxy pressure injection method.
      b. Concrete cracks using the hydrophilic injection sealant method.

1.02 RELATED SECTIONS

A. Contract Agreement
B. Division 1 - General Requirements
C. Section 02070 - Demolition
D. Section 03100 - Concrete Forms and Accessories
E. Section 03200 - Concrete Reinforcement
F. Section 03300 - Cast-in-Place Concrete

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01300:
   1. Product Data: Manufacturer's descriptive product data, current specifications and installation instructions for materials proposed for the work of this Section. Data shall substantiate that each product meets the requirements set forth in this Section.
2. Sketches of repair sites indicating type of repair, location, approximate dimensions and areas to be repaired.

3. Certification from the product manufacturer’s representative stating in writing that the manufacturer:
   a. Is familiar with the project and aware of the job conditions.
   b. Agrees with the intended application of the specified products.
   c. Agrees to provide necessary supervision or direction to ensure the product’s satisfactory application.

4. Submit references and project information to demonstrate the proposed concrete repair contractor’s experience on projects of comparable scope and complexity.

1.04 QUALITY ASSURANCE

A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
1. American Concrete Institute (ACI):
   a. ACI 308.1, Curing Concrete.
   b. ACI 546, Concrete Repair Guide.
   a. ASTM A82, Steel Wire, Plain, for Concrete Reinforcement.
   b. ASTM A185/A185M, Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
   c. ASTM A276, Stainless Steel Bars and Shapes.
   d. ASTM C494/C494M, Chemical Admixtures for Concrete.
   e. ASTM C881, Epoxy-Resin Based Bonding Systems for Concrete.
   f. ASTM C884, Thermal Compatibility of Concrete and an Epoxy-Resin Overlay.
3. International Concrete Repair Institute (ICRI):
4. Society for Protective Coatings (SSPC); Steel Structures Painting Manual.
   a. SSPC - SP2, Hand Tool Cleaning.
   b. SSPC - SP3, Power Tool Cleaning.

B. Manufacturer’s Representative Services: Engage the services of the product manufacturer’s field service representative to supervise the initial application of each concrete repair material and perform the following technical services:
1. Conduct a pre-installation conference with representatives of the Contractor, the Project Manager and the applicator performing the concrete repair work to provide detailed instructions and procedures to be used in the installation of the concrete repair materials, including surface preparation, mixing, application and curing.
2. Witness the initial application of each repair material and make subsequent site visits, as needed or as requested by the Project Manager, to ensure that the repair materials are being installed properly and as intended.
3. Submit a technical service report within seven days after the site visit to document the discussions, observations and recommendations made on site.

C. Applicator qualifications:
1. Utilize a concrete repair contractor having demonstrated experience on projects of comparable scope and complexity and acceptable to the product manufacturer in writing.
2. Provide at least one person who shall be present at all times during execution of the work of this Section and who is thoroughly familiar with the type of materials being used and the means and methods to install them.
D. Follow the recommended practices outlined in ACI 546 and ICRI Technical Guideline No. 03730 with regard to surface preparation, placement and curing of concrete repair materials or the concrete repair procedures specified herein, whichever is more stringent.

1.05 DELIVERY, STORAGE AND HANDLING

A. Conform to the requirements of Section 01600.
B. Assume sole responsibility for properly receiving, handling and storing all materials furnished under this Section from the time that such materials are delivered to the site until final acceptance of the work by SEPTA.
C. Maintain packaged materials in original containers with labels intact and with seals unbroken until time of use. All contained material shall have readable labels for the duration of the work.
D. Store materials above ground in a dry place to avoid damage to material by water, freezing and the effects of weather.

1.06 PROJECT CONDITIONS

A. Do not perform any repair work without prior approval of the Project Manager for location, limits and type of repair.
B. Prior to commencement of the work, field verify existing types, quantities, locations and conditions applicable to the concrete rehabilitation work. Actual field-verified conditions may require modifications to the concrete rehabilitation details indicated on the Contract Drawings. Obtain approval of the Project Manager prior to modifying the concrete rehabilitation details. Perform the work to meet actual field conditions encountered.
C. Be advised that existing embedded reinforcement may be encountered at repair sites.
D. Remove and dispose of damaged concrete, related material and all debris in accordance with the applicable provisions of Section 02070.
E. When using abrasive blasting, concrete sawing or chipping equipment, shield all work for the protection of the public and workers on the site.
F. Some products specified may cause irritation to people through contact, inhalation of vapors, or ingestion, or may present other hazards.
G. Safety precautions are solely the Contractor’s responsibility. Take the necessary precautions to protect people from irritation and injury due to this work.
H. Heed all label warnings by product manufacturer.
I. Do not proceed with the installation of repair products under adverse weather conditions when joint to be injected and sealed is frozen, or when temperatures are below or above the product manufacturer’s recommended limitations for installation. Consult the product manufacturer for specific instructions before proceeding.

1.07 MEASUREMENT AND PAYMENT

A. Measurement
   1. The Contractor shall perform all measurements for payment of concrete repairs in the presence of the Project Manager or designated representative.
   2. The Contractor shall prepare a listing of the types, locations and quantities of pre-qualified concrete repairs performed as described herein, including the units and actual quantities repaired under each repair category and present this list to the Project Manager for review and approval.
3. The approved quantities of repair material actually incorporated in the work, delineated by the specified unit of measurement, will be the basis for payment.

4. Unit cost items and corresponding units of measure for concrete rehabilitation work shall be as follows:
   a. Shallow Concrete Spall Repair for Horizontal Surfaces (2” maximum depth) - square feet
   b. Shallow Concrete Spall Repair for Vertical and Overhead Surfaces (2” maximum depth) - square feet
   c. Deep Concrete Spall Repair (deeper than 2”) - square feet
   d. Concrete Crack Repair Using Epoxy Pressure Injection Method - linear feet
   e. Concrete Crack Repair Using Hydrophilic Injection Sealant Method - linear feet

B. Payment
   1. Payment for all work performed under this Section shall be determined by the agreed-upon quantities of concrete repairs actually incorporated in the work.
   2. The basis for payment shall be the actual measured quantity of each repair type incorporated in the work, delineated by the specified unit of measure, multiplied by the corresponding contractual unit price shown on the Bid Form.
   3. No separate payment will be made for surface sealing cracks and securing injection ports with epoxy resin compound prior to pressure injection of cracks. The costs thereof shall be included in the respective unit price bids for concrete crack repairs.

PART 2 – PRODUCTS

2.01 CONCRETE SPALL REPAIRS

A. Shallow Concrete Spall Repairs (2” Maximum Depth)
   1. General: Applicable to repair of shallow (2” maximum depth) concrete surface spalls and delaminations in existing abutments, walls, bridge seats and slabs. Shallow spall repairs shall be made using a two-component, polymer-modified structural repair mortar formulation based on the orientation of the spalled surface.
   3. Repair of Horizontal Top Surfaces
      b. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
         1) SikaTop 122 Plus, Sika Corporation, Lyndhurst, NJ.
         2) Duraltop Fast Set; Euclid Chemical Co., Cleveland, OH.
         3) SD2 Repair Mortar; MBT Protection and Repair Division of BASF Building Systems, Shakopee, MN.
         4) Or approved equal.
   4. Repair of Vertical and Overhead Surfaces:
      a. Use a two-component, polymer-modified, portland cement, fast-setting, nonsag mortar specifically intended for repairs of vertical and overhead surfaces.
      b. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
         1) SikaTop 123 Plus; Sika Corporation, Lyndhurst, NJ.
         2) Duraltop Gel; Euclid Chemical Co., Cleveland, OH.
         3) HB2 Repair Mortar; MBT Protection and Repair Division of BASF Building Systems, Shakopee, MN.
         4) Or approved equal.
c. Mechanical Expansion or Chemical Adhesive Anchors: Provide mechanical expansion or chemical adhesive anchors and nuts to anchor vertical and overhead spalled surfaces in accordance with the concrete repair details shown on the Contract Drawings and as specified in Section 05120.

B. Deep Concrete Spall Repairs (Deeper than 2")
   1. General: Applicable to repair of concrete surface spalls and delaminations greater than 2" in depth for horizontal, vertical and overhead repairs in existing abutments, walls, bridge seats and slabs. Deep spall repairs shall be made using formed plasticized concrete anchored to the concrete substrate.
   2. Plasticized Concrete: Provide plasticized concrete that conforms to the provisions of Section 03300 for normal weight, cast-in-place concrete of minimum design compressive strength (f'c) of 4,500 psi at 28 days, except as follows:
      a. Coarse aggregate: Maximum 3/8" nominal (i.e., pea gravel).
      b. Do not use liquid membrane-forming curing compounds.
   4. Steel Wire: ASTM A82, W4 or D4 minimum size.
   5. Concrete Formwork: Provide formwork that conforms to the requirements of Section 03100.
   6. Concrete Reinforcement: Provide new epoxy coated reinforcing bars of same size and spacing as existing reinforcement in accordance with the repair details shown on the Contract Drawings and as specified in Section 03200.
   7. Anti-Corrosion Protective Coating and Bonding Agent: Provide a 3-component, water-based, epoxy-modified, cementitious, corrosion-resistant, VOC-compliant bonding agent suitable for bonding fresh mortar or concrete to exposed reinforcing steel surfaces. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
      a. Armatec 110 EpoCem; Sika Corporation, Lyndhurst, NJ.
      b. Corr-Bond; Euclid Chemical Company, Cleveland, OH.
      c. Or approved equal.

2.02 CONCRETE CRACK REPAIRS

A. Hairline cracks narrower than 0.02" (20 mils) shall not be repaired unless otherwise directed by the Project Manager.

B. Concrete Crack Repair Using Epoxy Pressure Injection Method
   1. General: Applicable to cracks not exceeding 0.25" in width. Repairs shall be made using a two-component epoxy resin material injected under pressure.
   2. Epoxy Resin for Pressure Injection: Use a two-component, 100-percent solids, moisture-tolerant, low viscosity, epoxy resin system specifically intended for pressure injecting cracks in concrete.
   3. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
      a. Sikadur 52, Sika Corporation, Lyndhurst, NJ.
      b. Duralcrete LV; Euclid Chemical Company, Cleveland, OH.
      c. SCB Concresive 1350; MBT Protection and Repair Division of BASF Building Systems, Shakopee, MN.
      d. Or approved equal.

C. Concrete Crack Repair Using Hydrophilic Injection Sealant Method
   1. General: Applicable to repair of cracked surfaces of concrete abutments and wingwalls. Repairs shall be made using a hydrophilic polyethylene resin sealant injected under pressure regardless of crack width.
2. Hydrophilic Sealant: Polyurethane grout and accelerator system: Non-toxic, low viscosity, hydrophobic polymer of the isocyanate type to be mixed with an accelerator based on tertiary amines with a controlled reaction time of one to 10 minutes depending on the mix preparation. When the grout is mixed with 0.5% to 5% accelerator, the mixture will react upon contact with water and expand to five to seven times its original volume and cure to a polyurethane foam.

3. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
   a. Hydro-Active Flex LV with accelerator Hydro-Active Flex Cat; DeNeef Construction Chemicals, Inc., Waller, Texas.
   b. Scotch Seal Chemical Grout 5600 (Foam); 3M Construction Market Division, St. Paul, Minnesota.
   c. SikaFix HH LV; Sika Corporation, Lyndhurst, NJ.
   d. Or approved equal.

4. Physical Properties of Hydrophobic Polymer:
   a. Uncured Viscosity: 650cps ± 100 cps at 68°F (ASTM D1638)
   b. Cured Tensile Strength: 150 psi (ASTM D190-1963)
   c. Cure Elongation: 250% (ASTM D3574)
   d. Cured Shrinkage: Less Than 4% (ASTM D1042)

5. Reaction Time Accelerator: Type recommended by the manufacturer of the sealant for the specific joint surface and conditions.

D. Epoxy Compounds for Surface Sealing Cracks and Securing Injection Ports: Use a two-component, 100-percent solids, moisture-tolerant, high-modulus epoxy resin system specifically intended for surface sealing cracks and securing injection ports prior to pressure injection. Use product for both epoxy pressure injection and hydrophilic sealant injection methods.

1. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
   a. Sikadur 33, Sika Corporation, Lyndhurst, NJ.
   b. Euco #452 Gel Epoxy System; Euclid Chemical Company, Cleveland, OH.
   c. NC Adhesive; MBT Protection and Repair Division of BASF Building Systems, Shakopee, MN.
   d. Or approved equal

PART 3 – EXECUTION

3.01 SHALLOW CONCRETE SPALL REPAIRS

A. General
   1. Shallow concrete spall repairs consist of the removal of unsound concrete and the repair of spalled and delaminated concrete surfaces not exceeding 2 inches in depth, using a polymer-modified structural repair mortar as determined on the basis of a field inspection conducted by the Contractor in the presence of the Project Manager or designated representative.

2. Shallow concrete repairs are applicable to horizontal, vertical and overhead surfaces.

3. Do not repair spalled or otherwise defective concrete surfaces less than 1/4” in depth unless otherwise directed by the Project Manager.

B. Repair Procedure
   1. Inspection: In the presence of the Project Manager, inspect concrete surfaces to determine the type of repair, limits and locations of all areas to be repaired as work of this Section.
2. Make a 1" deep saw cut around the perimeter of the repair area. Saw cut area shall be approximately square or rectangular in shape. Remove spalled, scaled, loose and deteriorated concrete to sound concrete. Use a maximum 28 lb. size pneumatic hammer or other approved method to remove deteriorated concrete. Hydro-demolition techniques are not permitted.

3. Determine sound matrix by observation of the concrete chipping operation, by sounding the concrete with a rod or hammer, or other device acceptable to the Project Manager. Afford and accommodate the Project Manager access to the work in progress and provide use of the chipping gun as a means of evaluating the quality of the residual matrix. The determination of "sound" matrix will be predicated on the general criterion that concrete which is difficult to remove with a chipping gun is "sound".

4. If reinforcing steel is encountered at a repair site during concrete removal, notify the Project Manager and follow the instructions described herein for deep concrete spall repairs.

5. Thoroughly clean, air blast and vacuum the newly exposed area prior to installing repair mortar. Remove all debris from the site in accordance with the provisions of Section 02070.

6. For vertical and overhead repairs only, install mechanical expansion anchors and nuts at the grid pattern indicated in the concrete repair details shown on the Contract Drawings. Maintain 1/2" minimum concrete cover.

7. Thoroughly mix structural repair mortar in accordance with manufacturer’s written directions. Wet the surfaces to be repaired to a saturated surface dry (SSD) condition. Apply Anti-Corrosion Protective Coating and Bonding Agent while the bonding agent is still wet. Apply structural repair mortar, in lifts as required, to be flush with adjacent surfaces and protect against damage in accordance with the manufacturer's recommended installation and curing instructions.

3.02 DEEP CONCRETE SPALL REPAIRS

A. General
1. Deep concrete spall repairs consist of the removal of unsound concrete and the repair of spalled and delaminated concrete surfaces in areas greater than 2" deep, or less than 2" deep if existing reinforcing steel is encountered, using formed, plasticized concrete as determined on the basis of a field inspection conducted by the Contractor in the presence of the Project Manager or designated representative.

2. Deep concrete repairs are applicable to horizontal, vertical and overhead surfaces. Deep spall repairs shall be made using formed plasticized concrete anchored to the concrete substrate.

B. Mixing Plasticized Concrete
1. For hand or batch mixing of plasticized concrete, provide scale approved by the Project Manager in which cement, fine and coarse aggregates and admixtures can be accurately weighed for the required mix proportions.

2. Provide measuring instruments with graduated markings in inches for the proportioning of the air entraining admixture and water reducing-high range admixture. Do not mix these admixtures together before adding to the mix; the resultant solution will not perform as intended. Do not add these admixtures in the mixture simultaneously; these admixtures shall be added separately in the mixing cycle. Store, mix and use manufactured materials in strict accordance with the written recommendations of the respective manufacturer.

C. Repair Procedure
1. Inspection: In the presence of the Project Manager, inspect concrete surfaces to be repaired under work of this Section to determine the type of repair, limits and locations of all areas to be repaired as work of this Section.
2. Make a 1” deep saw cut around the perimeter of the repair area. Saw cut area shall be approximately square or rectangular in shape. Remove spalled, scaled, loose and deteriorated concrete to sound concrete. Use a maximum 28 lb. size pneumatic hammer or other approved method for deteriorated concrete removal. Hydro-demolition techniques are not permitted.

3. Remove unsound concrete material in a manner to facilitate the uniform placement of freshly placed concrete to preclude the entrapment of air or forming of voids.

4. Remove all resulting debris from the site in accordance with the provisions of Section 02070.

5. Render all surfaces of exposed concrete and reinforcing steel free of oil, solvent, grease, dirt, dust, bitumen, rust, loose particles and other foreign matter. Thoroughly clean, air blast and vacuum the newly exposed area prior to forming.

6. Use caution where reinforcing steel is uncovered so as not to damage the steel or its bond in the surrounding concrete. Do not use pneumatic tools in direct contact with reinforcing steel. Use a maximum 28 lb. size hammer for chipping behind reinforcing steel. Clean exposed reinforcing steel in accordance with SSPC-SP2, Hand Tool Cleaning, or SSPC-SP3, Power Tool Cleaning, to remove all contaminants, rust and rust scale.
   a. In areas where reinforcing steel is found to be surrounded by deteriorated concrete, has at least one-half of its surface area exposed, or has less than 1” concrete cover, the depth of removal shall be such as to include all deteriorated concrete but not less than 3/4” below and behind the reinforcing steel.
   b. Where exposed existing reinforcing steel is severely corroded or damaged as indicated on the Contract Drawings or in the opinion of the Project Manager, remove rust from the existing reinforcing steel and splice with new epoxy coated reinforcing steel of the same size and spacing. Where existing reinforcing steel is determined by the Project Manager to have insufficient cover, either replace reinforcing steel or adjust as directed by the Project Manager. Attach new epoxy coated reinforcing steel behind existing reinforcement with a minimum lap splice of 1’-4”. Remove concrete to a minimum depth of 3/4” behind the new epoxy coated reinforcing steel.


8. Install formwork at vertical and overhead repair sites in accordance with Section 03100. Coat forms with a plastic coating or similar type film to facilitate form removal. Design forms so that placement access will be at the top of each formwork assembly for vertical repairs.
   a. Prior to forming vertical or overhead surfaces, install reinforcement as indicated on the Contract Drawings or as required and directed by the Project Manager.

9. Coat exposed surfaces of reinforcing steel with Anti-Corrosion Protective Coating and Bonding Agent prior to casting plasticized concrete.

10. Do not use bonding compounds to bond fresh plasticized concrete to concrete substrate. Dampen exposed concrete substrate surfaces immediately prior to placement of fresh concrete.
    a. At time of placement, plasticized concrete shall have a consistency capable of being molded by hand.
    b. Place concrete and consolidate during placement with appropriately sized vibrators.
    c. Small holes may be drilled into forms to permit air to escape during placement and consolidation.
11. Curing Concrete
   a. Cure concrete in forms for a minimum of seven (7) days in accordance with the
      requirements of Section 03300. Keep continuously wet throughout the seven
      (7) day period.
   b. After curing and stripping of forms, blend the patched areas to match the
      physical appearance of the adjacent area as closely as possible.
   c. The Project Manager will sound the patched areas to detect the presence of
      hollow spots. Remove and repair such defects to the satisfaction of the Project
      Manager at no additional cost to SEPTA.

12. Testing
   a. During the entire period of concrete placement, the Testing and Inspection
      Agency will provide on-site and off-site testing services for Deep Spall Concrete
      Repairs similar to the services described in Section 03300 for normal cast-in-
      place concrete placement.
   b. Provide access to the Project Manager or the designated representative and
      the Testing and Inspection Agency to inspect or test the work at all reasonable
      times.

3.03 CONCRETE CRACK REPAIRS

A. General
   1. This work consists of repairing concrete cracks greater than hairline width (0.02” or 20
      mils) as determined on the basis of a field inspection conducted by the Contractor in
      the presence of the Project Manager or designated representative. Do not repair
      cracks less than 0.02” (20 mils) in width unless otherwise directed by the Project
      Manager.
   2. Before crack repair work is commenced, clean slab and wall surfaces to remove
      mineral deposits, laitance, loose material on the surface, grease, oil and all visible
      contaminates.

B. Crack Repairs Using Epoxy Pressure Injection
   1. Apply this crack repair method to cracks not exceeding 0.25” in width. Repairs shall
      be made using a two-component epoxy resin material injected under pressure in
      accordance with the procedures described herein and as shown in the concrete repair
      details on the Contract Drawings.
   2. Use automated pressure injection equipment to supply, meter, mix and dispense the
      two components of the epoxy resin into the prepared cracks. The unit shall be
      portable and be equipped with positive displacement-type pumps with interlock to
      provide positive ratio control of exact proportions of the two components of the epoxy
      resin at the nozzle. The pumps shall be air powered or electric and shall be equipped
      with an in-line mixing and metering system and contain drain-back plugs.
   3. Thoroughly clean structural cracks and completely remove foreign matter such as dirt,
      laitance, grease, salt or any other contaminants.
   4. Apply epoxy surface seal compound to the face of the crack along its entire length
      prior to the application of injection material.
   5. Establish openings in the surface seal (entry ports) along the crack as required by the
      technical representative of the manufacturer. The distance between the entry ports
      shall not be greater than the thickness of the concrete member being repaired. For
      structures accessible on both sides, provide porting devices on opposite sides at
      staggered elevations.
   6. Begin the injection of the epoxy compound by pressure at the entry port at the lowest
      elevation. Continue injection at the first port until the injection material begins to flow
      out of the port at the next higher elevation or the adjacent port. Plug the first entry
      port and start injection at the second port and continue until the epoxy resin flows from
the next port. Inject the entire crack following the same sequence. Perform the entire technique in strict accordance with the manufacturer's written or on-site instructions.

7. After the injection compound has cured, remove the surface seal completely. Finish the face of the crack flush with the adjacent concrete. Indentations or protrusions caused by placement of entry ports will not be acceptable. Clean the repaired surfaces adequately to receive finish treatment as specified in other sections of the work.

C. Crack Repairs Using Hydrophilic Injection Sealant

1. Apply this crack repair method to vertical and overhead cracks in concrete slabs, abutments and wingwalls, bridge seats, retaining walls that presently leak, exhibit signs of previous leakage or are subject to groundwater infiltration. Execute repairs using a hydrophilic polyethylene resin sealant injected under pressure regardless of crack width.

2. Protect walls, floor slabs, ductwork, piping and lighting below repair area to prevent staining due to spillage and migration of sealant compound of the cracks.

3. Clean crack surfaces and remove all mineral deposits and foreign matter.

4. Determine location of existing slab, wall and beam reinforcing steel bars along the length of the crack.

5. Drill test injection holes on the interior face of the crack, install test injectors and test pump water to determine spacing for injectors along the crack. Drill hole size, spacing and injector size shall be in accordance with the instructions of the manufacturer’s technical representative. The distance between the entry ports shall not be greater than the thickness of the concrete member being repaired. Do not drill through or damage existing reinforcing steel bars.

6. Drill remainder of holes for grout injection and install grout injectors. Do not drill through or damage existing reinforcing steel bars.

7. Flush the cracks with clean water to remove dirt, dust and other contaminants.

8. Install all materials in accordance with the manufacturer’s instructions unless otherwise directed.

9. Do not install sealant at a temperature below 41°F unless the manufacturer specifically permits application of those materials at a lower temperature. Consult with the manufacturer’s representative.

10. Use pressure injection equipment of a type, capacity and mechanical condition suitable for performing the work. Ensure that the sealant plant is of the continuous mixing type and is capable of supplying, proportioning, mixing and pumping the sealant in accordance with the recommendations of the grout manufacturer. Ensure that the hoses, check valves and other equipment have low moisture permeability and are compatible with the sealant.

11. Pump water into cracks that appear to be dry prior to injecting sealant.

12. Begin sealant injection into a crack at the lowest elevation and proceed upward on vertical cracks or begin at one end and proceed toward the other end on horizontal cracks.

13. Pump sealant into the first injector until sealant is observed at the second. Close the valve on the first injector and disconnect the supply line. Pump sealant into the second injector and repeat operation until the crack has been completely sealed.

14. Plug sealant leaks immediately with rags or oakum dipped in hydrophilic sealant or by other methods approved by the manufacturer.

15. Remove injectors and other fittings after grout has reached gel point. Fill any remaining holes with drypack mortar.
3.04 CLEANING

A. As work progresses, immediately remove excess materials from adjacent surfaces with cleaning material recommended by the appropriate material manufacturer. Avoid contamination of work area.

B. Finish exposed crack and spall repairs to obtain a hard steel trowel finish for unformed surfaces or rubbed finish for formed surfaces, as applicable, in accordance with the exposed surface finish requirements of Section 03300.

C. Grind repaired surface flush with adjacent concrete surface that will be left exposed or painted. Provide float finish at repaired floor surfaces scheduled to receive floor tile.

D. Do not discharge debris or waste into sewers or waste piping.

E. Leave finished work in neat and clean condition.

3.05 FIELD QUALITY CONTROL

A. Use adequate number of skilled personnel who are thoroughly trained and experienced in the materials and workmanship requirements specified herein and who are completely familiar with the methods needed for proper performance of the concrete rehabilitation work of this Section.

B. Manufacturer's Representative Services: Do not proceed with the first application of each concrete repair material without the installation contractor's personnel having received on-site detailed instructions from the product manufacturer's field services representative on the surface preparation, mixing, application and curing of the concrete repair materials for the intended use.

C. Non-conforming Work: Repaired concrete surfaces which develop shrinkage cracks greater than approximately 0.01” (10 mils) wide, honeycombing or a significant frequency of cracking within 28 days after installation shall be considered defective and shall be classified as non-conforming work.

D. Repair or remove and replace non-conforming work as directed by the Project Manager and at no additional cost to SEPTA. Patch non-conforming repaired surfaces with a suitable, approved patching material, mix or product as directed by the Project Manager.

END OF SECTION 03600
SECTION 03700
REINFORCED OR PLAIN CEMENT CONCRETE PAVEMENTS

PART 1 – GENERAL

1.01 DESCRIPTION
A. This work is construction of normal strength or High Early-Strength (HES) cement concrete pavement, plain or reinforced, on a prepared surface, as indicated.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements

1.03 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications
      b. PennDOT Publication 35, Bulletin 15, Approved Construction Materials

PART 2– MATERIALS

2.01 CLASS AA CEMENT CONCRETE
A. See PennDOT Publication 408, Specification, Section 704.

2.02 HES CEMENT CONCRETE
A. See PennDOT Publication 408, Specification, Section 704.

2.03 REINFORCEMENT
A. See PennDOT Publication 408, Specification, Sections 709.3 and 709.4.

2.04 EXPANSION JOINT FILLER
A. See PennDOT Publication 408, Specification, Section 705.1.

2.05 LONGITUDINAL JOINT MATERIAL
A. See PennDOT Publication 408, Specification, Section 705.2

2.06 LOAD TRANSFER UNITS
A. See PennDOT Publication 408, Specification, Sections 705.3(a) and (b).
2.07 JOINT SEALING MATERIAL
   A. See PennDOT Publication 408, Specification, Section 705.4(a), (b), or (d)

2.08 GRAPHITE LUBRICANT
   A. See PennDOT Publication 408, Specification, Section 705.6.

2.09 CONCRETE CURING MATERIAL
   A. See PennDOT Publication 408, Specification, Sections 711.1, 711.2(a), Type 2, and 711.2(b).

2.10 CONCRETE ADMIXTURES
   A. See PennDOT Publication 408, Specification, Section 711.3.

2.11 MORTAR
   A. See PennDOT Publication 408, Specification, Section 705.7(b).

2.12 TAPE BOND BREAKER
   A. An acceptable self-adhesive tape the width of the sealant reservoir.

2.13 EPOXY BONDING COMPOUND
   A. See PennDOT Publication 408, Specification, Section 706.1.

2.14 JOINT BACKING MATERIAL
   A. See PennDOT Publication 408, Specification, Section 705.

2.15 FIBERGLASS DOWEL SLEEVE
   A. An approved type as listed in PennDOT Bulletin 15 – Approved Construction Materials.

2.16 PRE-MIXED NONSHRINK GROUT
   A. An approved type as listed in PennDOT Bulletin 15 – Approved Construction Materials.

PART 3 – EXECUTION

3.01 GENERAL
   A. Construct pavements in one or two traffic lane widths as shown on Standard Drawings RC 20M, 21M, 23M, 24M, 25M, 26M, and 27M, unless otherwise directed. Use one-lane construction if two-lane construction interferes with traffic.
   B. Field Operation QC Plan
      1. Prepare a paving operation QC Plan, as specified in Section 01400 for field control and evaluation of concrete paving operations for the Project Manager’s review. Do not start paving until after the Project Manager reviews the QC Plan.
   C. Construct Trolley Slab as follows: Completely consolidate the concrete around the trolley track structure to encase the track structure. Operate the vibrator around but not in touch
with the track structure. Do not disturb to track structure alignment during placement and consolidation. Place and finish the concrete around the trolley track rail boot as indicated. Form and finish the flangeway form on the gage side of each trolley track as indicated.

3.02 WEATHER RESTRICTIONS

A. In the event that operations for placement of concrete for bridge approach slabs and moment slabs occur during the winter months, the Contractor must submit to the Project Manager the following:
   1. Submit the method of insulation and heating of the deck areas to the Project Manager for review and approval before placing concrete.
   2. Submit the method of curing in accordance with Publication 408 to the Project Manager for review and approval before placing concrete.

B. Cold Weather
   1. Unless otherwise permitted in writing, discontinue concreting operations when the descending air temperature, away from artificial heat, falls to 40°F. Do not resume operations until the air temperature, away from artificial heat, rises above 40°F. Do not let water with a temperature above 90°F to come in direct contact with the cement, until the cement has been mixed with the aggregates. Place concrete when the concrete temperature is between 50°F and 90°F. Do not use materials containing frost, lumps, or crusts of hardened materials. Do not place concrete on frozen base, subbase, or subgrade.

C. Hot Weather
   1. When the air temperature in the immediate vicinity of concrete operations rises to 85°F, take thermometer readings of the plastic concrete, at 1/2-hour intervals and at the conclusion of the mixing cycles. Discontinue concrete operations if the plastic concrete temperature exceeds 90°F after mixing. When the plastic concrete temperature rises to 90°F, cool the mixing water or aggregates to maintain a plastic concrete temperature within 50°F to 90°F at the time of placing.

3.03 CONCRETE MIXTURE

A. Do not use mixtures from volumetric mixing plants or mobile mixers, unless approved by SEPTA in writing. For slip-form paving, the Contractor may use plant mixed cement concrete, volumetric mixing plants or mobile mixers as specified in Section 03300.

3.04 FORMS

A. Use steel forms for concrete pavement except as specified herein. Use forms not less than 10 feet in length, with form depth and base width equal to pavement depth. Do not exceed 1/8 inch in 10 feet from the true plane of the face or top. The Contractor may use forms with a base of not less than 6 inches in width and meeting all other requirements for narrow strips of widening if approved by SEPTA in writing.

B. Use forms of an approved section without horizontal joints, and with flange bracing extending outward on the base not less than two-thirds of the form height. Use forms that do not deflect or deform more than 0.01 inch when a center load of 1,700 pounds is applied within a 4-foot span. Use form sections equipped with three stake pockets, each of which have positive non-detachable wedges, and positive interlocking devices, which form a neat tight joint. Use a sufficient quantity of steel pins to securely hold the forms in place and provide the necessary rigidity.

C. For curves with a radius of less than 150 feet, the Contractor may use wood forms. Use two 1-inch (nominal) seasoned, surfaced planks properly joined together. Brace all wood forms with steel pins. Do not exceed 24 inch spacing between pins.
D. Clean and oil forms before each concrete placement. Cut and firm the subbase under the forms true to grade, and set forms accurately to line and grade for their entire length and width. Forms may be shimmed provided that the material used to shim the forms creates continuous contact between the form and the base course surface. The forms and shimming material must result in a full vertical face of concrete when removed. If concrete extrudes outside the shims or forms, remove this extruded concrete, as directed, before placing the adjacent concrete.

3.05 PREPARATION AND PROTECTION OF BASE COURSE
A. When placing concrete on the completed base course do not disturb the form line after final testing. Remove accumulation of material adjacent to forms, to full depth of forms, in conjunction with final testing. If the prepared area is disturbed by any operations, or by traffic, check and correct before placing concrete.
B. Thoroughly sprinkle water on the base course before paving if necessary, to ensure a moist base course and to cool the surface temperature of treated permeable base courses below 115°F. Discontinue paving operations if the surface temperature of treated permeable base courses cannot be maintained below 115°F. Do not create water puddles or mud. Sprinkle the base course with as much water as it readily absorbs, well in advance of paving.

3.06 PLACEMENT AND INITIAL STRIKE-OFF OF CONCRETE
A. For pavement construction around manholes, inlets, valve boxes, and similar appurtenances, place premolded expansion joint filler not less than 1/2 inch in total thickness, for the full depth of the pavement, around the outer sides of structures within the paved areas. Where pavements adjoin other rigid structures, bridges, or culverts, place premolded expansion-joint filler, not less than 3/4-inch thick, adjacent to the structures. Before placing pavement adjacent to railway tracks, fill the spaces along the web and below the head and top flange of the rail with mortar. If construction crosses railway tracks, place a minimum 3/4 inch thick expansion joint filler against the mortar-filled rails. If constructing along tracks, place a minimum 1/4 inch thick expansion joint filler along each mortar-filled rail.
B. Do not use concrete that has developed an initial set.
C. If implanting dowel bars by mechanical means, the Contractor may deposit the concrete directly on the subgrade or prepared surface in front of the paver. Spread concrete as close as possible to joint assemblies to ensure proper concrete consolidation without disturbing the joint. Do not damage the prepared surface while transporting or depositing concrete ahead of the paver. If the prepared surface is an asphaltic leveling course on rubblized concrete, treated base course of cement or asphalt, or an aggregate subbase, travel on the prepared surface only in the immediate area of the paving operation for the purpose of depositing concrete ahead of the paver. Do not use the prepared surface for hauling. Satisfactorily repair or replace any damaged areas at no additional cost to SEPTA.
D. Use vibrators capable of transmitting vibration to concrete with a frequency of not less than 100 impulses per second. Operate the vibrator around, but not in contact with transverse or longitudinal joint assemblies. Do not cause segregation when vibrating. Do not operate manual vibrators in one place more than 5 seconds. Use vibrators only to consolidate concrete after it has been properly placed. Do not use vibrators to move or spread concrete. Remove and discard segregated concrete, as directed. Maintain sufficient reserve vibratory equipment to prevent shutdown due to failure of equipment.

3.07 SLIP-FORM PAVING METHOD
A. Equipment
1. Use a fully energized, self-propelled, slip-form paving machine, equipped with side forms to support concrete laterally to prevent edge slumping. Use a paver that vibrates or tamps concrete for the full width and depth of the layer being placed.

B. Line and Grade
1. Unless otherwise specifically shown on the construction drawings, construct pavement so the longitudinal joints do not traverse a driving lane or conflict with the final pavement markings. Construct longitudinal joints parallel to and within 12 inches of final pavement markings unless otherwise detailed on the construction drawings.

C. Placing Concrete
1. Place the concrete and spread in one or more layers, provided the concrete is fully consolidated, the reinforcement is satisfactorily embedded, and a satisfactory finished surface is obtained.
2. Operate the slip-form paver in a continuous forward movement. Coordinate operations of mixing, delivering, placing, and spreading concrete to provide uniform progress with stopping and starting of the paver held to a minimum. If the paver’s forward movement is stopped, immediately disengage vibrating and tamping elements.

D. Joints
1. When load transfer units are used, stake in place in advance of paving operations, at the designated locations. Implanting of dowel bars by mechanical means is permitted. Accurately mark the dowel-bar locations to ensure sawing the transverse joints over the center of dowels. Saw, cure, and protect transverse and longitudinal contraction joints, as specified in Sections 3.09 and 3.10.

E. Edge Slumping
1. During Paving Operations
   a. Test the pavement surface for edge slumping with a 10-foot straightedge, before the concrete becomes non-plastic. Strive to avoid edge slump. Edge slump not exceeding the following will be acceptable:
      1) 1/8 inch between adjacent lanes, and lanes and ramps
      2) 1/4 inch between lanes and shoulders, and ramps and shoulders
   b. Measure edge slump for the 6-inch width contiguous to the pavement edge.
   c. Suspend paving operations after 200 feet if edge slumping cannot be prevented or controlled within the above stated acceptable limits. The pavement within this 200-foot section will be evaluated as specified in Section 3.07.E.2.
2. After the Concrete Hardens
   a. Test the pavement surface with a 10-foot straightedge to ensure the requirements of Section 3.07.E.1 have been met.
   b. If testing confirms edge slumping exists in the hardened concrete, submit methods for correction to SEPTA for review. Make corrections according to the reviewed methods to eliminate the edge slumping. Remove and replace pavement determined defective, as specified in Section 3.20, at no additional cost to SEPTA.

3.08 HANDLING AND PLACING REINFORCEMENT

A. Use reinforcement free of rust, dirt, oil, grease, or other foreign substances, which impair bond of steel with concrete. A light, powdery coating of rust, formed during project storage, does not require cleaning. Remove loose, scaly, or thick rust by suitable methods. The Project Manager will reject reinforcement with rust that has caused detectable reduction in cross-sectional area.

B. If placing reinforced concrete pavement in two layers within fixed forms, strike off the entire bottom layer and lay the reinforcement full length on the concrete, in its final position, without further manipulation. Place reinforcement directly upon the concrete and place, strike-off,
and screed the top layer of concrete. Remove and replace bottom-layer portions of concrete placed more than 1/2 hour without being covered with the top layer of freshly mixed concrete.

C. If placing reinforced concrete pavement in one layer, position mesh reinforcement on acceptable supports as specified in PennDOT Publication 408, Specifications, Section 1002.3(d)2 in advance of concrete placement. If a mechanical installer is used, avoid segregation of concrete or displacement of reinforcement.

3.09 TRANSVERSE JOINTS

A. In new multilane pavements, place transverse joints perpendicular to centerline to form a continuous joint across the entire pavement width and locate dowels as shown on Standard Drawing RC 20M, except where paving operations must cease temporarily due to unavoidable conditions.

B. Before paving, apply graphite bond-breaker lubricant to one-half of the length of Type B coated dowel bars, unless a bondbreaker lubricant has been applied in the shop. Stir the lubricant well and apply to the free end of dowels by daubing, mopping, or with a gloved hand, to produce a thorough coating approximately 1/16 inch thick. Do not use brushes for lubricant application. Apply the lubricant, as specified, at least 1 hour before placing the concrete around the dowel assembly. Type A coated dowel bars do not need lubricant.

C. Where existing concrete pavements are widened, align transverse construction or contraction joints, if possible, with existing construction or contraction joints or cracks; otherwise, do not place within 10 feet of a joint.

D. When constructing pavement one lane at a time or placing concrete shoulders after pavement construction, fill the ends of transverse joints with joint backing material, or cover with duct tape, to prevent intrusion of cement mortar into the joint. In these cases, when saw cutting transverse joints in the newly constructed lane or shoulders, saw cut the existing transverse joint in the previously placed lane to ensure the removal of any mortar that might have intruded into the joint.

E. Construction Joints

1. If more than a 30-minute interruption occurs in concreting operations, construct a transverse joint using a bulkhead. Place dowels in bulkheads by drilling or inserting into fiberglass dowel sleeves. Do not construct a transverse joint within 10 feet of another transverse joint. If not enough concrete has been placed or mixed at the time of interruption to form a slab at least 10 feet long, remove concrete to the preceding joint and dispose of excess mix.

F. Contraction Joints

1. Accurately mark using tacks or other approved methods the location for the center of the sawed transverse contraction joints. The sawed transverse joint must be located directly ±1/2 inch over the centerline of the dowel basket assemblies or the centerline of the mechanically implanted dowels. Saw joints with equipment having guides, a blade guard, watercooling system, and cut-depth control. Provide adequate and extra equipment and parts at the site, before placing concrete and during sawing operations.

2. Other than white membrane curing compound, remove curing materials from pavement, at the location where a joint is to be cut. Only remove sufficient covering to provide space necessary for sawing joints. Immediately after sawing the initial saw cut, thoroughly flush the joint as necessary to remove slurry. Place oversized (width plus 50%) backer rod in the top of the sawed joint to maintain cure. Monitor the movement of the joint throughout the cure period and up to placement of permanent seal. If at any time the joint opens remove and replace backer rod with appropriate
oversized backer rod. The maximum time period permitted for curing covers to be removed for sawing is 1/2 hour. If white membrane curing compound is used, reapply curing compound as specified in Section 3.12.F.4.

3. The Project Manager will not allow displacing coarse aggregate from the joint location by use of a vibrating T-bar, or by use of a filler strip at the joint.

4. In single-lane construction, mark the joints that have cracked and opened on the first lane placed. Align the location of the first joints sawed in the second lane with the marked joints on the first lane. In lanes adjacent to previously constructed lanes, saw joints before uncontrolled cracking occurs. Make the full required depth cut from edge to edge of the pavement. In formed paving, do this by loosening or removing the side forms or by other acceptable methods.

5. Saw all initial saw cuts to prevent random cracking, without damaging the pavement surface. If damage to the pavement surface occurs, repair in an approved method at no additional cost to SEPTA. Slight raveling along the joint edge is permissible. If necessary, conduct sawing operations continuously, both day and night, regardless of weather conditions.

6. If a crack or spall occurs at any location and any time before final inspection and resolution of all issues regarding the condition of the pavement, repair the pavement in accordance with Table A, at no additional cost to SEPTA. Field coat the dowels with the graphite lubricant, as specified in Section 309, where necessary as determined by the Project Manager. Join original pavement to replacement pavement and test as specified in PennDOT Publication 408, Specifications, Section 507; if Ride Quality and Incentive are not applicable, test as specified in Section 3.15.

7. For joints requiring a second stage of sawing, saw the sealant reservoir 72 hours or more after placing the concrete.

8. Clean joints with pressurized water or water and air pressure immediately after sawing. Patch voids or spalls, in excess of the specified width, as specified in PennDOT Publication 408, Specifications, Section 525. Continue curing and protect joint until sealed.

G. Expansion Joints
1. Place transverse expansion joints, where indicated. If existing concrete pavements are widened, align transverse expansion joints, if possible, with existing expansion joints. Place transverse expansion joints, without load transfer units, in the plain cement concrete pavement in paved divisor areas. Conform to the dimensions and locations in adjacent concrete curb. Place expansion joint filler, as indicated or as directed.

<table>
<thead>
<tr>
<th>Item</th>
<th>Deficiency</th>
<th>Location</th>
<th>Description</th>
<th>Contractor Repair Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Partial Depth Crack</td>
<td>Anywhere</td>
<td>≤ 0.007 inches wide</td>
<td>Do nothing</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&gt; 0.007 inches wide AND ≤ D/3 deep</td>
<td>Epoxy inject crack as specified in PennDOT Publication 408, Section 1091</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&gt; 0.007 inches wide AND &gt; D/3 deep</td>
<td>Repair as specified in PennDOT Publication 408, Section 516 Partial Panel Full Depth Patch(^a, b, c)</td>
</tr>
<tr>
<td>2</td>
<td>Spall</td>
<td>Mainline or should panel</td>
<td>Minimal spalling(^a) ≤ 2 inches wide AND ≤ D/3 deep</td>
<td>Do nothing</td>
</tr>
<tr>
<td>3</td>
<td>Single Full Depth Crack (any orientation)</td>
<td>Shoulder</td>
<td>Non-working crack with minimal spalling(^d)</td>
<td>Epoxy inject crack as specified in PennDOT Publication 408, Section 1091</td>
</tr>
<tr>
<td>3</td>
<td>Single Full Depth Crack (any orientation)</td>
<td>Shoulder</td>
<td>Working crack with minimal spalling(^d)</td>
<td>Seal crack as specified in PennDOT Publication 408, Section 590</td>
</tr>
<tr>
<td>3</td>
<td>Single Full Depth Crack (any orientation)</td>
<td>Shoulder</td>
<td>Crack with significant spalling(^e)</td>
<td>Repair as specified in PennDOT Publication 408, Section 516 Partial Panel Full Depth Patch(^a,b,c) OR Full Panel Replacement(^c)</td>
</tr>
<tr>
<td>Mainline or Should panel is affected by irregular geometry (construction joints do not line up)</td>
<td>Mainline</td>
<td>Crack with minimal spalling(^d)</td>
<td>Seal crack as specified in PennDOT Publication 408, Section 590</td>
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<tr>
<td>Mainline</td>
<td>Mainline</td>
<td>Entire length of crack ≤ 9 inches from longitudinal joint AND crack is parallel to longitudinal joint ±1 inch</td>
<td>Seal crack as specified in PennDOT Publication 408, Section 590</td>
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<tr>
<td>Mainline crack is in center one-third of dowelled panel</td>
<td>Mainline</td>
<td>Crack ≤ 1/8 inch wide AND spalling ≤ 1/4 inch from edge of crack.</td>
<td>Dowel Retrofit as specified in PennDOT Publication 408, Section 527: three dowels per wheel path (panels ≤ 10 inches thick); four dowels per wheel path (panels &gt; 10 inches thick) OR Partial Panel Full Depth Patch(^a,b,c) repaired as specified in PennDOT Publication 408, Section 516 OR Full Panel Replacement(^c)</td>
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<tr>
<td>Mainline</td>
<td>Mainline</td>
<td>All other conditions</td>
<td>Partial Panel Full Depth Patch(^a,b,c) OR Full Panel</td>
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<td>4</td>
<td>Multiple Cracks &gt; D/3 deep (any orientation)</td>
<td>Mainline or Shoulder</td>
<td>Panel has more than 1 crack &gt; D/3 deep</td>
<td>Partial Panel Full Depth Patch (^{a,b,c}) OR Full Panel Replacement (^c)</td>
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Notes:

a. Minimum patch length is 6 foot for Plain Cement Concrete (PCC) or 10 foot for Reinforced Concrete Pavement (RCP).
b. Minimum amount of panel left in place is 6 foot.
c. All patches (partial panel and full panel replacements) must be full width and depth.
d. Minimal spalling is defined as ≤ 2 inches total width AND ≤ 12 inches (combined length) along crack.
e. Significant spalling is defined as > 2 inches total width OR > 12 inches (combined length) along crack.

Payment for new pavement where the crack has been removed is at the Contract Unit Price (CUP) with NO additional compensation for the repair.

Payment for new pavement where the crack has not been removed but sealed as specified in PennDOT Publication 408, Specifications, Section 590 is at five percent CUP for the slab with NO additional compensation for the repair. Payment for slabs with Partial depth Crack or Spall is at the CUP with NO additional compensation for the repair.

Crack depth is to be determined by coring at no cost to SEPTA.

### 3.10 LONGITUDINAL JOINTS

A. Place tie bars as indicated or directed. The Project Manager will select 15 tie bars from the first day's concrete placement according to PTM No. 1. Test each selected tie bar for pull-out resistance after the concrete has attained a compressive strength of 3,500 pounds per square inch, or epoxy anchoring material has met manufacturer’s requirements. Use a center-pull hydraulic jack with a load measuring gage and bearing ring capable of testing each tie bar to 12,000 pounds or to a 1/32-inch slippage. Do not use jack and gage having a calibration date older than 6 months. Record the gage reading at point of slippage or 12,000 pounds, whichever occurs first. Determine the average of pull-out test results. Divide pull-out test average by the tie bar spacing to determine pull-out resistance of tie bars, in pounds per cubic foot, for compliance with Table B. If the pounds per cubic foot is not in compliance with Table B, replace failed tie bars or install additional tie bars until compliance with Table B is attained, at no additional cost to SEPTA. Install additional tie bars from the center of slab out in an approved pattern. Do not install additional tie bars within 30 inches of a transverse joint. Do not construct adjacent lanes until the tie bars comply with Table B. Perform additional testing as directed.

B. Saw tied, longitudinal contraction joints to prevent random cracking, as specified in Section 309.F.2. Clean joints with pressurized water or water and air pressure immediately after sawing. Continue curing and protect the joint until it is sealed, as specified in Section 3.14.

#### TABLE B

**Pull-Out Resistance of Tie Bars**

<table>
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<tr>
<th>Tied Width of Pavement (Distance from Joint Being Constructed to Nearest Free Edge)</th>
<th>Minimum Average Pull-Out Resistance of Tie Bars</th>
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<tr>
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<td>Ib/ft of Joint</td>
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<td>12 feet or less</td>
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<td>Over 12 feet to 17 feet</td>
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C. If a longitudinal crack occurs within a lane, remove and replace slabs containing the crack at no additional cost to SEPTA. If damage to the pavement surface occurs, repair in an approved method at no additional cost to SEPTA. Join original and replacement pavements. Field coat dowels with graphite lubricant, as specified in Section 3.09, where necessary.

3.11 FINAL STRIKE-OFF, CONSOLIDATION, AND FINISHING

A. Complete these operations during hours of natural light, unless using an acceptable lighting system.

B. Strike-Off and Consolidation

1. Machine Method
   a. Immediately after placing, strike off and screed the concrete, with a finishing machine, as necessary, to properly consolidate the concrete and to leave a uniform textured surface.
   b. Keep the top of forms free from accumulation of concrete or of foreign material. Maintain true machine travel on the forms without lift, wobble, or other variations that affect accurate finishing. Use equipment that does not groove the concrete pavement edges for a width greater than can be eliminated by edging tools. Use a rubber-tired wheel to support the spreader and a transverse finishing machine on the adjoining concrete pavement surface, keeping the wheel approximately 12 inches from the pavement edge.
   c. Maintain a uniform roll of concrete ahead of the finishing machine front screed for its entire length. Overlap the previously screeded concrete on the last pass.
   d. Place and vibrate concrete adjacent to joints and other areas, as specified in Section 3.06, then bring the finishing machine forward. Operate the machine carefully to avoid damage, misalignment of joints, or concrete segregation.
   e. Do not add water to the concrete surface to assist in finishing.

2. Manual Method
   a. Unless otherwise directed, do not use manual strike-off methods, except to strike off concrete already deposited on the subbase if a breakdown of mechanical equipment occurs or on small turnout areas and patches up to 10 feet in length.
   b. If finishing manually, use screeds contoured to the pavement cross section. Provide screeds sufficiently rigid to retain their shape and at least 2 feet longer than the maximum slab width to be struck off. Operate the equipment in a manner to obtain consolidation and a uniform textured surface free of porous areas. Consolidate as specified in Section 3.06.

3. Floating
   a. After the concrete has been struck off and consolidated, smooth and fill in open-textured pavement areas with a float, as necessary. Do not add water to the surface. Mechanical floats or long handled floats may be used.

4. Straightedge Testing Surface Correction
   a. While concrete is still plastic, test the surface using a 10-foot straightedge, swung from handles 3 feet longer than one-half the slab width, as required. Hold the straightedge in contact with the surface in successive positions. Advance in successive stages of not more than 5 feet a stage. Immediately correct low areas, then strike off, consolidate, and refinish. Cut down high areas and refinish. Make sure the surface across joints meets requirements for smoothness as specified in Section 3.15. Continue straightedge testing and surface corrections until the entire surface is free from observable departures.
from the straightedge and until the slab conforms to the required grade and cross-section.

5. Final Finish
   a. After straightedge testing and surface corrections have been completed and before concrete becomes non-plastic, texture the surface transversely for the full pavement width. Produce a textured finish with grooves that have the following characteristics: rectangular in shape; from 3/32 inch to 3/16 inch in width; and from 1/8 inch to 3/16 inch in depth.
   b. For a 10-foot rake use center-to-center tine spacing as follows:

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   c. When using this chart begin in the upper left corner and read across the entire row then start again on the left side in the next row.
   d. Produce the texture in one pass, without overlapping the previous pass, to provide a uniform finish. Keep the texturing device free of hardened concrete particles.

6. Longitudinal Texture
   a. When indicated, or when requested in writing and approved by SEPTA, construct the final finish, in lieu of the random transverse texture specified above, as follows:
   b. After straightedge testing and surface corrections have been completed and before concrete becomes non-plastic, provide initial texturing with a burlap drag or broom device to produce striations parallel with centerline. Perform final texturing with a spring steel tine device to produce grooves parallel with centerline. Operate the spring steel tine device within 5 inches, but not closer than 3 inches, of pavement edges. Produce a textured finish with grooves that have the following characteristics:
      1) Parallel with centerline
      2) Rectangular in shape
      3) 1/8 inch (± 1/64 inch) in width
      4) 1/8 inch to 3/16 inch in depth, and
      5) 3/4 inch nominal center-to-center tine spacing
   c. Install burlap drags, brooms and tine devices on self-propelled equipment having external alignment control. Maintain the area of burlap in contact with the pavement surface constant at all times during texturing. Provide positive elevation control for broom and tine devices. Maintain down pressure on pavement surface at all times during texturing to achieve uniform texturing without measurable variations in pavement profile. Operate self-propelled texturing machines to maintain constant travel speed when texturing. For small or irregular areas, or during equipment breakdown, hand methods may be approved by the Project Manager. If unsatisfactory results are obtained, stop the placement of concrete until the equipment deficiency or malfunction is corrected.
   d. When diamond grinding surface corrections are made in the hardened concrete for pavement smoothness, no additional texturing is required.
### 3.12 CURING CONCRETE

A. Cure the entire surface immediately after finishing operations have been completed. Do not mar the concrete surface. After removing forms and correcting honeycombed areas, cure the sides with the same method as the surface. When using covers, secure over the entire surface and sides. The Project Manager will suspend concrete operations immediately if sufficient curing is not provided. Cure by the same method throughout the work unless directed to change by the Inspector. Have material available for emergency curing.

B. If normal curing is delayed, apply an intermediate monomolecular film curing agent to all cement concrete patches before normal curing.

C. Apply the monomolecular film in a light-fog application, using a pressure spray tank with an adjustable nozzle. Use a water-to-curing-agent ratio and rate of application both according to the manufacturer's recommendations. Agitate the solution before each application.

D. Apply the curing agent in a continuous film, immediately after finishing and texturing operations are completed on any area. Do not provide any additional finishing after application of the monomolecular film. Apply additional applications as required, if surface drying is taking place and curing covers have not been placed.

E. After application of the monomolecular film, provide normal curing as specified.

F. Normal Curing
   1. Apply curing materials and maintain them as specified below, for a period of 96 hours for normal strength concrete or 72 hours for HES concrete. The Contractor may use methods other than those described below to protect and cure joints, if the procedure and materials are acceptable. The Project Manager may require a change in method if unsatisfactory results are obtained.
   2. White Polyethylene Curing
      a. Use sheeting wide enough to cover the pavement surface and sides. Provide lengths consistent with pavement joint spacing. Overlap sheets a minimum of 12 inches and secure sides and seams to form a tight seal. After form removal, fold sheeting down over the sides for the full pavement depth, then secure with suitable material.
   3. White Polyethylene Burlap-Backed Curing
      a. Use sheeting wide enough to cover the pavement surface and sides. Provide lengths consistent with pavement joint spacing. Overlap sheets a minimum of 12 inches, then secure sides and seams to form a tight seal. Saturate the burlap side with water, then place and secure with the burlap side down. After form removal, fold sheeting down over the sides for the full pavement depth, then secure with suitable material.
   4. White Membrane Forming Curing Compound
      a. The Project Manager will allow this method of curing if the air temperature is above 40F at the time of application and the air temperature is forecasted to remain above 40F a period of 4 hours after application.
      b. Following the final finishing, immediately after free water has left the pavement surface and while the surface is still damp, seal exposed concrete areas with an application of curing compound. Apply at a rate of 1 gallon per 150 square feet ± 10% of surface area, or as directed. Using a self-propelled mechanical spreader, apply in a fine mist, without marring the concrete surface. Use atomizing type spraying equipment, equipped with a tank agitator providing continual compound agitation during application. Provide proper calibration to allow accurate control of the amount of material being placed. Use a hood to protect the spray device against the wind and control so the spray overlaps transversely 50%, to produce two coverages of a continuous, uniform membrane. Do not drip curing compound on the pavement. If rain falls on newly
coated pavement before the film has dried sufficiently to resist damage or if film is damaged in any way before the pavement is cured, apply a new coat immediately, in an amount equal to the original specified application.

c. After form removal, apply a uniform coat to the sides, at the rate specified for the surface. Manual spraying equipment may be used for spraying the sides and for any small or irregular areas not reached by surface spraying equipment.

d. The Contractor may cure joints and protect them by use of tape, a strip of white polyethylene, or white polyethylene backed with burlap. During the curing period, to prevent moisture loss from concrete, in and adjacent to joints, use strips 3 inches to 6 inches wide, securely held in place on the pavement surface by an acceptable method, or place saturated rope strands in the joints. Just before the curing compound application or reapplication, carefully place rope without damaging or distorting the joints.

e. Keep workmen, materials, and equipment off the membrane film during curing, unless adequate precautions are taken to protect the film.

5. Burlap Curing
   a. Place burlap in double-thickness by overlapping each strip one-half its width on the pavement surface. Keep this covering saturated with water for the full curing period. After sides are exposed, fold burlap down over the sides and secure with suitable material.

6. White Polypropylene Fiber-Backed Curing
   a. Use sheeting wide enough to cover the pavement surface and sides. Provide lengths consistent with pavement joint spacing. Overlap sheets a minimum of 12 inches, then secure sides and seams to form a tight seal. Saturate the burlap side with water, then place and secure with the burlap side down. After form removal, fold sheeting down over the sides for the full pavement depth, then secure with suitable material.

7. Black Membrane-Forming Curing Compound
   a. Liquid Membrane-Forming Curing Compound, Black, may be used, provided the cement concrete pavement will be overlaid and is not accessible to traffic before the surface course is placed. Apply at a rate not to exceed 0.015 gallon per square yard to produce a uniform continuous film. Discontinue use of the compound if it becomes unsatisfactory as a curing agent; and resume curing by other methods, as specified.

G. Cold Weather Curing
   1. If the forecasted air temperature during concrete curing is expected to fall below 40F, place high-low thermometers on the concrete surface and monitor concrete curing temperatures. Protect the pavement surface and sides to effectively maintain a temperature of not less than 40F for at least 4 days and until the concrete achieves a strength of 3,000 pounds per square inch. If at any time during this period the high-low thermometer falls between 40F and 35F, extend the cure period by an additional day. If at any time during the curing period the high-low thermometer temperature falls below 35F, the concrete will be considered defective. Remove and replace defective pavement as specified in Section 3.20 at no cost to SEPTA.

3.13 REMOVAL OF FORMS
   A. Do not remove forms from freshly placed concrete until it has set. Remove the forms carefully to avoid pavement damage.

3.14 SEALING JOINTS AND CRACKS
   A. Seal joints before opening any pavement section to traffic including construction equipment, and before discontinuing work for the winter season. When permitted, the Contractor may
open pavement to construction equipment provided an approved temporary sealing material is in place, and initial concrete strength and curing requirements are met. Provide construction equipment within vehicle code limits. Seal cracks as indicated or directed.

B. Do not place joint sealing material on the same day as the sawing or if joint is wet or damp due to weather conditions. Clean joints of all scale, dirt, curing compound, temporary joint sealing material, and other foreign material with a wire brush. Upon completion of the cleaning, thoroughly sand-blast or water-blast the joint sidewalls with sufficient pressure to clean but not damage joint. Immediately before placing bond breaker or joint sealing material, blow the joint clean with a compressed air stream of at least 100 pounds per square inch measured at the source. Use compressed air free of oil, moisture, and other contaminants.

C. Poured In Place Seal
   1. Do not place poured joint-sealing material if the air temperature is less than 40F, unless permitted.
   2. For hot-poured seals, use heating equipment of an indirect heating type, constructed as a double boiler. Provide positive temperature control and mechanical agitation. Determine the safe heating temperature range and recommended pouring temperature from the manufacturer's shipping container. Heat and maintain the material temperature within these recommended safe temperatures. Place the material as close as possible to the recommended pouring temperature. Do not maintain any single batch of material at the pouring temperature for more than 6 hours. Reheat according to the manufacturer's recommendations.
   3. Fill the joint reservoir with sealing material to the level shown on the Standard Drawings. Do not allow sealing material to spread over the pavement surface.
   4. When required, place the tape bond breaker and/or backer rods on the bottom surface of the joint reservoir before sealing. Do not extend tape up the reservoir face more than 1/8 inch. If necessary for support, install an acceptable joint backing material below the tape.

D. Neoprene Seals
   1. Install preformed neoprene seals as specified, using installation equipment capable of placement without cutting, nicking, twisting, or damaging the seal. Install seals with lubricant adhesive applied, according to manufacturer's recommendations, to the contact surfaces of the joint faces or sides of the seal. Install seal in one piece to the depth indicated unless approved. Do not elongate the seal more than 3% or compress longitudinally more than 2%.
   2. Prepare and submit a QC Plan to the Project Manager at the start of the project, as specified in Section 01400. As a minimum include the following in the QC Plan: Contractor's and manufacturer's representatives; list of equipment and construction sequence; list of material, along with sampling and testing procedures; test section schedule; and procedure to replace unacceptable seals.
   3. Before sealing joints, seal a minimum of three full-width pavement joints, according to the test section schedule specified in the QC Plan. Have the manufacturer's representative witness the test section(s) unless otherwise permitted in writing. The Project Manager will inspect the test section(s). Do not seal the remaining pavement joints until the Project Manager accepts an installation procedure. Conduct test(s) according to QC Plan when material is changed or seal installations are unacceptable.
   4. Replace seals exceeding 3% elongation or 2% compression, or otherwise not conforming to the specifications at no expense to SEPTA. Patch pavement damaged by removing unacceptable seals and adhesive as specified in PennDOT Publication 408, Specifications, Section 525.

E. Silicone Tolerance
1. Prepare the joint and place silicone sealant material according to the manufacturer's recommendations.

3.15 SURFACE TOLERANCE

A. After the concrete has hardened, test the surface of pavement again, using straightedges, as specified in Section 3.11.B.4. Remove high points in excess of 1/4 inch by means of grinding or cutting tools, as directed. The Project Manager will consider pavement containing depressions of more than 1/4 inch to be defective.

B. Longitudinal Joints

1. Test the surface of pavement at all longitudinal joints, including the joint between the pavement and shoulder, again for the following tolerance requirements:
   a. Where there is no change in the design cross slope across a joint, the tolerance will not be greater than 1/4 inch as measured by holding a 10-foot straightedge centered across and perpendicular to the joint.
   b. Where there is a change in the design cross slope across a joint, the tolerance will not be greater than 1/4 inch as measured by holding a 4-foot straightedge perpendicular to and on each side of the joint.
   c. Remove high points in excess of 1/4 inch by means of grinding or with cutting tools, as directed. Pavement containing depressions of more than 1/8 inch between adjacent lanes will be considered defective.

3.16 PROTECTION OF PAVEMENT

A. Protect pavement, as specified in Section 09010, and exclude traffic, including construction equipment. When required to complete adjacent pavement, the spreading, finishing, and subgrade machines may operate on the pavement surface after 96 hours if 3,000 pounds per square inch is achieved.

B. Late Season Pavements

1. Apply Boiled Linseed Oil Mixture as specified in PennDOT Publication 408, Specifications, Section 503.3 on all concrete pavements and shoulders constructed after September 1.

3.17 OPENING TO TRAFFIC

A. The Project Manager will determine when pavement may be opened to traffic. However, do not open to traffic in less than 96 hours for normal strength concrete or 72 hours for HES concrete and until pavement develops the required 3,000 pounds per square inch minimum compressive strength, determined by compressive tests made on cylinder specimens, according to PTM No. 604 or determined by maturity method according to PTM No. 640.

3.18 PROTECTION AGAINST RAIN

A. Provide sufficient materials on site, at all times, to properly protect the pavement edges and surface against rain, before initial set of concrete. If rain appears imminent, stop paving operations, immediately protect the pavement sides, and cover the concrete surface with protective material.

3.19 TESTS FOR DEPTH

A. Before final acceptance of the project, proceed as follows:
   1. SEPTA will divide the mainline pavement into lots representing not more than 3,000 square yards of pavement in each traffic lane. A traffic lane is defined as the pavement surface between longitudinal joints or between a longitudinal joint and the pavement edge. Include ramps in a separate lot or lots. The Inspector will select one
coring location at random within each lot according to PTM No. 1. Drill cores according to AASHTO T 24 and in the presence of the Inspector. Thoroughly clean the vertical surface of the core hole of laitance and loose and foreign material. Fill the holes with the mixture used to construct the course and consolidate. As an alternative, use a premixed, nonshrink grout

2. Provide a measuring apparatus conforming to PTM No. 614. The Inspector will determine the core depth according to PTM No. 614.

3. If any core measurement is deficient by more than 1/4 inch in required depth, drill additional cores in the presence of and for measurement by the Inspector.

4. Drill the additional cores at 100-foot intervals in both directions longitudinally from each deficient core, in the same traffic lane, until the depth is no more than 1/4 inch deficient. Each core will represent the condition in the same traffic lane for a distance of 50 feet in both directions longitudinally.

5. If any core measurement is deficient by more than 1/2 inch in required depth, the Inspector will consider the pavement to be defective.

6. Submit every fifth core as an information sample to the LTS where an evaluation will be made of the entrained air content according to PTM No. 623, and for 28 day compressive strength testing according to AASHTO T 24. For a partial lot, the Inspector will randomly select one core, according to PTM No. 1, for testing. If the core strength is less than 3,750 pounds per square inch immediately perform an investigation of the concrete operations to determine the cause of the low strength. Provide a written evaluation of the problem and the proposed solution to SEPTA.

3.20 DEFEECTIVE WORK

A. Unless otherwise directed in writing by SEPTA, remove and replace pavement that is: defective in construction or sawing of transverse joints as specified in Section 3.09; defective in curing requirements as specified in Section 3.12G; defective in surface tolerance, as specified in Section 3.15; defective in depth, as specified in Section 3.19; defective in air content, as specified in PennDOT Publication 408, Specifications, Section 704.1(c)3; defective in compressive strength as specified in PennDOT Publication 408, Specifications, Section 704.1(d), or showing surface defects resulting from the effects of freezing and thawing, rain, improper final finish, or honeycombing which, in the Project Manager's opinion, cannot be repaired. Repair pavement that is cracked or spalled in accordance with Table A.

B. The minimum pavement removal and replacement length between transverse joints is 10 feet if constructing reinforced cement concrete pavements or 6 feet if constructing plain cement concrete pavements. After removal of defective pavement, construct required transverse joints according to the methods for joining pavements, as shown on the Standard Drawings. Where replacement extends to an existing transverse joint, satisfactorily salvage the joint or replace in kind, as directed.

C. If removing and replacing pavement defective in depth, start at the determined point of deficiency as determined by the Project Manager. Remove and replace defective work transversely for the full-lane width and longitudinally, until the pavement is not more than 1/4 inch deficient in depth, as specified in Section 3.19.

END OF SECTION 3700
PART 1 – GENERAL

1.01 DESCRIPTION
A. This work is construction of reinforced concrete approach slabs and associated sleeper slabs, including the subbase material and necessary excavation.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements

1.03 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
a. PennDOT Publication 408, Specifications

PART 2 – MATERIALS

2.01 SUBBASE
A. See PennDOT Publication 408, Specifications, Section 350.2.

2.02 REINFORCED CEMENT CONCRETE PAVEMENT
A. See PennDOT Publication 408, Specifications, Section 501.2.

2.03 BITUMINOUS PAPER
A. See PennDOT Publication 408, Specifications, Section 727.

2.04 POLYETHYLENE SHEETING
A. See PennDOT Publication 408, Specifications, Section 711.1(a).

2.05 CONCRETE CURING MATERIALS
A. See PennDOT Publication 408, Specifications, Section 711.1.
PART 3 – EXECUTION

3.01 GENERAL
   A. As shown on the Standard Drawings, approved Contract Drawings, as specified in PennDOT Publication 408, Specifications, Section 501.3, except Section 501.3(1), and as follows per this Section.

3.02 EXCAVATION
   A. Excavate for the sleeper slab after constructing the subbase.

3.03 POLYETHYLENE SHEETING
   A. Two layers of 4.0 mil minimum polyethylene sheeting to be used as a bond breaker under bridge approach slabs. Provide surface that is smooth without excessive depth of sheeting.
   B. Install any seams in the longitudinal direction of the bridge and overlap seams a minimum of 12 inches.
   C. Provide certification from the manufacturer concerning the above material requirements.

3.04 CONCRETE CURING
   A. Cure the approach slab in accordance with PennDOT Publication 408, Specifications, Section 1001.3(p), except PennDOT Publication 408, Specifications, Section 1001.3(p)3.a, and as follows:
      1. Water cure bridge approach slabs for a minimum of 7 days. Use covers of a double thickness of burlap

END OF SECTION 03800
SECTION 03900
RETAILING WALL MODIFICATIONS

PART 1– GENERAL

1.01 DESCRIPTION
A. The work specified in this Section consists of all labor, materials, equipment and services necessary to raise/modify the existing north east retaining wall approximately 0 to 1.83 feet from Sta. 2+36.23 to Sta. 3+42.50 as shown on the Contract Drawings and install new replacement protective fence.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02160 – Excavation Support and Protection
D. Section 02170 – Vibration Monitoring
E. Section 02220 – Excavation, Backfill and Compaction
F. Section 02280 – Geotextiles
G. Section 02910 – Structure Foundation Drain
H. Section 03100 – Concrete Forms and Accessories
I. Section 03200 – Concrete Reinforcement
J. Section 03300 – Cast-in-Place Concrete
K. Section 03600 – Concrete Rehabilitation
L. Section 05540 – Protective Fence and Gate

1.03 SUBMITTALS
A. Submit the following in accordance with Section 01300:
   1. Submit catalog cut sheets for light weight fill.

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. Publication 408, Specifications

PART 2– PRODUCTS

2.01 CLASS AA CEMENT CONCRETE
A. See Section 03300 Cast-in-Place Concrete.
2.02 EPOXY COATED REINFORCEMENT
   A. See Section 03200 Concrete Reinforcement.

2.03 DOWEL BAR ADHESIVE
   A. Use an approved adhesive anchoring material as listed in PennDOT Bulletin 15, Section 516.2(k) Anchor Material.

2.04 LIGHTWEIGHT FILL
   A. Use AERO FG-G15 Foamed glass aggregate as manufactured by AERO Aggregates, 1500 Chester Pike, Eddystone, PA 19022, or approved equal.

2.05 CAULKING COMPOUND
   A. See PennDOT Publication 408, Section 705.8.

2.06 GEOTEXTILE, CLASS 1
   A. See Section 02280 Geotextiles.

2.07 6" FOUNDATION DRAIN
   A. See Section 02910 Structure Foundation Drain.

2.08 6" PVC PIPE, SCHEDULE 40
   A. See Section 02910 Structure Foundation Drain.

2.09 NO. 57 COURSE AGGREGATE
   A. See PennDOT Publication 408, Section 735.

PART 3– EXECUTION

3.01 EXCAVATION
   A. Excavate soil under existing sidewalk to the elevations indicated on the contract drawings.

3.02 CONCRETE WORK
   A. See Section 03300 Cast-in-Place Concrete.
   B. Drill holes for dowels at the locations and to the diameter and depth as indicated. Place dowels into holes and insert dowel bar adhesive to form a complete bond between the dowels and the concrete. Repair structure damage caused by dowel operations.

3.03 DRAINAGE
   A. Place 6" foundation drain below lightweight fill and provide 6" PVC outlet pipe through existing retaining wall as indicated on the contract drawings.
3.04 BACKFILL

A. Place lightweight fill to the limits indicated on the contract drawings in accordance with the manufacturer's specifications. Wrap lightweight fill in a Geotextile, Class 1.

END OF SECTION 03900
SECTION 05120
STRUCTURAL STEEL

PART 1– GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of all labor, materials, equipment and services necessary to furnish, fabricate, and erect structural steel and appurtenances in accordance with the extent of work and the details indicated on the Contract Drawings, as specified herein and as required for a complete installation.

B. Structural steel, as referenced herein, is that work defined in the AISC "Code of Standard Practice" and as otherwise shown on the Contract Drawings, including structural shapes, stiffeners, plates, bars, fasteners and other miscellaneous appurtenances required for a complete installation.

C. This Section includes structural steel shapes, plates, bars and fasteners required for the fabrication and erection of miscellaneous structure supports, structure reinforcements, equipment and utility supports and non-framing steel fabrications affecting structural steel.

D. This Section includes provisions for surface preparation and protective coating of structural and miscellaneous steel components, including galvanizing and painting, to the extent described herein and as shown or indicated on the Contract Drawings and in Section 09900.

E. The work includes all incidental and miscellaneous items not specified under another Section but required for the work of this Section, whether or not specifically referred to herein.

F. This Section includes, but is not limited to, the following items:
   1. Carbon and Stainless Structural Steel.
   2. Structural Steel; Plates, Shapes and Bars.
   3. Structural Steel Tubing and Pipe.
   4. Carbon and Stainless Steel Fasteners; Bolts, Nuts and Washers.
   5. Anchor Bolts, Nuts and Washers.
   6. Headed Anchors (Welded Shear Studs, field welding permitted).
   8. Bridge Disk Bearing Assemblies.
   10. Mechanical Expansion Anchors.
   13. Field Painting.

1.02 RELATED SECTIONS

A. Contract Agreement
B. Division 1 - General Requirements
C. Section 03300 - Cast-in-Place Concrete
1.03 SUBMITTALS

A. Submit the following in accordance with Section 01300:

1. Manufacturer’s Data: Submit manufacturer's specifications, test reports and installation instructions for all proposed materials, products and accessories.

2. Shop Drawings that depict all shop and erection details and schedules for fabrication and shop assembly of members including grade of steel, welding technique and sequence, cuts, copes, gussets and all other members, connections, holes, fasteners, camber, fabrication and erection tolerances, surface preparation, type of primer paint system and other coatings, weights of members, and critical clearances. Indicate all surface finishes and welds both shop and field, by symbols conforming to AWS Standards. Show relationship between structural steel, concrete, masonry and other materials and embedded items.

3. Design Calculations: Submit for review structural design calculations of all steel connections for which connection details or beam reaction values are not shown on the Contract Drawings. Calculations shall be prepared under the direct supervision of, and signed and sealed by, a licensed Professional Engineer registered in the Commonwealth of Pennsylvania and experienced in the structural design of structural steel connections.

4. Working Drawings that depict design and details of all required temporary supports, staying and bracing and shall include descriptive data, including design calculations, to illustrate the erection, transportation, and handling procedures including sequence of erecting and transfer of loads, if applicable.

5. Furnish setting diagrams, templates, and directions for the installation of anchor bolts, bearing plates, and other embedded items.

6. Shop drawings, showing fabrication and installation of steel guardrails including plans, elevations, sections, details of components and attachments to other units of work.
   a. Design calculations: Structural design calculations for fabricated steel guardrails to show compliance with minimum design loads prepared under the direct supervision of, and signed and sealed by, a licensed Professional Engineer registered in the Commonwealth of Pennsylvania.

7. AISC Quality Certification Certificates, currently applicable, for steel fabricator and erector.
   a. Evidence of AISC certificate(s) to verify that structural steel fabricator is currently certified as a Certified Bridge Fabricator – Simple (SBR) with a Fracture Critical Endorsement (F) under the AISC Quality Certification Program.
   b. Evidence of AISC certificate to verify that structural steel erector is currently certified for the erection of railroad bridge structures as an AISC Advanced Certified Steel Erector (ACSE) under the AISC Quality Certification Program.
   c. Submit evidence of required certifications for approval prior to fabrication of structural steel materials.

8. Welding Records and Data:
   a. Procedure for pre-qualifying welders and welding procedures. Submit a copy of procedure qualification test records for welding procedures other
than those set forth in Paragraph 5.1 of ANSI/AWS D1.1/D1.1M. Submit a copy of procedure qualification test records for all welding procedures for bridge work other than those set forth in Section 5 Qualification of ANSI/AASHTO/AWS D1.5M/D1.5.

b. Certified copy of qualification test record for each welder, welding operator, and tacker who will be employed in the work, whether in the fabrication shop or in the field. All welders shall be certified in accordance with ANSI/AWS D1.1/D1.1M, Structural Welding Code, Steel or ANSI/AWS/AASHTO D1.5M/D1.5, Bridge Welding Code, as appropriate.

c. Weld procedure qualification test records for all welds on fracture critical members, and accordingly, provide all other submittals required in accordance with requirements of the AREMA Manual for Railway Engineering, Chapter 15, Section 1.14, Fracture Critical Members.

d. Descriptive data for field welding equipment for shear stud welding, including type and electrical power requirements.

e. Evidence that the welding inspector and non-destructive testing personnel are certified in accordance with the requirements specified in ANSI/AWS/AASHTO D1.5M/D1.5, Section 6.1.

f. Test results of non-destructive inspection tests performed on shop and field welds to the Project Manager within 24 hours after the welds are made.

1) Indicate the type and location of shop and field welds tested, type and location of defects noted, measures taken to correct the defects and the test results of corrected welds.

2) Report any defective welds which are not corrected.

9. Notarized certificates of compliance for materials and products or certified copy of reports for analyses and tests required by referenced ASTM Specifications, including but not limited to:

a. Certified mill test reports

b. Affidavit of compliance with steel grades specified for bridge and structural steel components, including special requirements.

c. Test reports for filler metals for welding

d. Mechanical test for high strength threaded fasteners

e. Disk bearings

f. Paint certification.

10. Published certificate of approval or compliance from a recognized testing laboratory that each proposed type of post-installed chemical adhesive and mechanical expansion anchor proposed for use is compliant with and certified for use in accordance with applicable provisions of 2009 International Building Code.

11. Do not commence shop fabrication until Shop Drawings and Working Drawings applicable to that portion of work have been reviewed and approved in writing by the Project Manager.

1.04 QUALITY ASSURANCE

A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.

1. American Association of State Highway and Transportation Officials (AASHTO):

2. American Institute of Steel Construction (AISC):
      1) Specification for Structural Steel Buildings, with Commentary and Supplements.
      2) Code of Standard Practice for Steel Building and Bridges, with Commentary.
      3) Specification for Structural Joints Using ASTM A325 or A490 Bolts with Commentary.
   b. AISC Detailing for Steel Structures.

3. American National Standards Institute (ANSI):
   a. ANSI B18.2.1, Square and Hex Bolts.
   b. ANSI B18.2.2, Square and Hex Head Nuts.
   c. ANSI B18.22.1, Plain Washers.
   d. ANSI B46.1, Surface Roughness, Waviness and Lay.

   b. ANSI/AASHTO/AWS D1.5M/D1.5, Bridge Welding Code.

   a. ASTM A6, General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use.
   b. ASTM A36, Carbon Structural Steel.
   c. ASTM A53, Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
   d. ASTM A123, Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   e. ASTM A153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   g. ASTM A307, Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   h. ASTM A325, High-Strength Bolts for Structural Steel Joints.
   i. ASTM A500, Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   j. ASTM A563, Carbon and Alloy Steel Nuts.
   k. ASTM A572, High-Strength, Low-Alloy Columbium-Vanadium Structural Steel.
   l. ASTM A709/A709M, Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges.
   m. ASTM A992, Steel for Structural Shapes for Use in Building Framing.
n. ASTM F436, Hardened Steel Washers.

o. ASTM F1554, Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

6. American Railway Engineering and Maintenance-of-Way Association (AREMA):
   a. AREMA Manual for Railway Engineering.

7. Federal Specifications (FS):


9. Society for Protective Coatings (SSPC):
   a. SSPC-SP1 Solvent Cleaning.
   b. SSPC-SP2 Hand Tool Cleaning.
   c. SSPC-SP3 Power Tool Cleaning.
   d. SSPC-SP6/NACE No. 3 Commercial Blast Cleaning.
   e. SSPC-SP10/NACE No. 2 Near-White Blast Cleaning.
   f. SSPC-VIS 1-89 Visual Standard for Abrasive Blast Cleared Steel (Standard Reference Photographs).

10. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
    a. PennDOT Publication 408, Specifications
    b. Bulletin 15, Approved Construction Materials

B. Fabricator Qualifications: The structural steel fabricator shall be designated an AISC Certified Plant and certified as a Certified Bridge Fabricator - Simple (SBR) with a Fracture Critical Endorsement (F) through the AISC Quality Certification Program, at time of bid. The steel fabricator shall also meet the additional requirements for Fracture Critical Members specified in AREMA Manual, Chapter 15, Part 1, Section 1.14 – Fracture Critical Members. An alternate to AISC certification subject to SEPTA and the Engineer of Record approval, can be accepted where the fabricator submits documents meeting the requirements of IBC Chapter 17 Section 1704.2.2 Fabricator Approval, regularly fabricates the specified products and has fabricated the specified products with satisfactory service on five similar installations for a minimum of five (5) years.

C. Erector Qualifications: The steel erector shall be certified for the erection of railroad bridge structures as an AISC Advanced Certified Steel Erector (ACSE), at time of bid. The erector shall be experienced, regularly installs and erects steels similar to the project scope with satisfactory service on five (5) similar installations for a minimum of five (5) years. Before commencement of work, the steel erector shall provide written notification as required by OSHA 29 CFR 1926.752(e).

D. Bridge Steel Components: Provide bridge steel components that meet the physical and chemical characteristics of their respective ASTM standards as specified.

E. Structural Steel Connections

1. Design of structural steel connections for bridge and other steel structures for which connection details or beam reaction values are not shown on the Contract Drawings shall be performed under the direct supervision of a licensed Professional Engineer retained by the Contractor, currently registered in the Commonwealth of Pennsylvania and experienced in the structural design of structural steel connections.
2. Provide details of connections required by the Contract Documents to be selected or completed by structural steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.
   b. Engineering Responsibility: Fabricator's responsibilities include using a qualified licensed Professional Engineer currently registered in the Commonwealth of Pennsylvania to prepare structural analysis data for structural steel connections for bridges and other steel structures.

F. Design of details not otherwise indicated, and fabrication, assembly, and inspection of steel structures shall conform to the following applicable specifications, codes and publications, latest issue, except as modified herein:

1. Bridge Structures:
   a. Conform to AREMA Manual for Railway Engineering for design of details not otherwise indicated, and for the fabrication, assembly and inspection of steel structures.
   c. Fabrication: The quality of workmanship and finish shall be equal to the best general practice in modern bridge shops.
   d. Inspection and non-destructive testing of welds, where specified, for Non-Fracture Critical Members shall be performed by qualified personnel as specified in ANSI/AASHTO/AWS D1.5M/D1.5, Section 6.1.

2. Other Steel Structures:
   a. AISC Steel Construction Manual, 13th Edition, including the following:
      1) Specification for Structural Steel Buildings, with Commentary, AISC.
      2) Code of Standard Practice for Steel Buildings and Bridges, with Commentary, AISC.
      3) Specification for Structural Joints Using ASTM A325 or A490 Bolts, with Commentary, Research Council on Structural Connections, endorsed by AISC.
      4) IBC Chapter 17 (Section 1704 – Special Inspections)
   b. Detailing for Structural Steel, AISC.
   c. Structural Welding Code - Steel, ANSI/AWS D1.1/D1.1M.

G. Testing and Inspection

1. Materials and fabrication procedures are subject to inspection and testing in the mill, shop and field, conducted by the Testing and Inspection Agency in accordance with the requirements of Section 01410. Such inspections and tests shall not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.
2. Field bolted connections will be inspected and tested by the Testing and Inspection Agency. The Agency may verify the tightening of bolts by visual verification of the load indicator washer, by use of a direct tension indicator, or by using an inspection wrench in accordance with Section 9 of the "Specification for Structural Joints Using ASTM A325 or A490 Bolts." The inspection wrench shall be used on the element turned to initially tighten the bolt.
   a. Rejected bolts shall be either replaced or retightened as required. In cases of disputed bolt installation, the bolts in question shall be checked by a calibrated wrench certified by an independent testing laboratory. The cost of certification shall be at the Contractor's expense.

3. The Project Manager may elect to accept certificates of compliance for materials and products in lieu of specified testing procedures. Conform to the requirements of Section 01400.

4. Shop inspections may be made by the Project Manager and the Engineer at their discretion. Provide ample notice to the Project Manager prior to the beginning of any fabrication work so that inspection may be provided. Furnish all facilities for the inspection of materials and workmanship in the shop, and allow the inspectors free access to the necessary parts of the work.
   a. Inspectors shall have the authority to reject any material or work that does not meet the requirements of this Section.
   b. Inspection at the shop is intended as a means of facilitating the work and avoiding errors, but it is expressly understood that it will in no way relieve the Contractor from the responsibility for furnishing proper materials or quality of workmanship specified herein.

H. Welding Requirements
1. All welding shall be performed by ANSI/AWS certified welders under the immediate supervision of a representative of the Project Manager. Cooperate with and assist the Project Manager in the performance of its duties.
2. Welding procedures (WPS) are required for all welding, including prequalified procedures.
3. Welders and Welding Procedure Qualifications shall comply with AWS.
4. Submit Welder's Certificates for welders employed on the project and verify AWS qualification use within the previous six (6) months.
5. All shop and field welds for structural steel will be visually inspected by an ANSI/AWS qualified welding inspector under the direction of the Project Manager. The on-site inspector will be an ANSI/AWS Certified Welding Inspector in accordance with the requirements specified in Section 6 of ANSI/AWS D1.1/D1.1M. Submit the inspector’s certification/qualifications and verification of AWS qualification within the previous twelve (12) months. Welding inspection shall be in accordance with AWS D1.1/D1.5 and IBC Section 1704 Special Inspections.
6. Furnish a letter of certification for each welded connection stating that these requirements have been met.
7. Shop and field welded connections will be inspected and tested by the Testing and Inspection Agency as follows:
   a. The Testing and Inspection Agency will visually inspect all shop and field welds, except puddle welds.
   b. All fillet welds shall be 100% visually inspected.
c. All penetration welds shall be 100% inspected by MT, UT or similar methods.

d. The Testing and Inspection Agency will perform shop and field testing on a minimum of 10 percent of all fillet welds and 100% of all partial penetration groove welds by an appropriate non-destructive testing method, such as magnetic particle testing, as described in ANSI/AWS D1.1/D1.1M.

e. All full penetration groove welds will be visually inspected and tested by the Testing and Inspection Agency by pre-qualified radiographic or ultrasonic methods in accordance with the provisions of Chapter 6, Parts E and F, respectively, of ANSI/AWS D1.1/D1.1M.

f. Acceptance criteria shall meet the requirements of Chapter 6, Part C, of ANSI/AWS D1.1/D1.1M.

8. Correct or redo and retest welds that are required by the Project Manager or the Engineer to be corrected as directed, at the Contractor's expense and to the satisfaction of the Project Manager and the Engineer.

I. Certifications: Certified mill test reports or certified tests made by the steel fabricator or a testing laboratory for structural steel in accordance with ASTM A6 and the governing specification will constitute evidence of conformity with the ASTM Specification.

J. Coordination: Coordinate work of this Section with the work of other trades so that construction is not delayed.

K. Site Safety

1. Accept total responsibility for structural steel erection procedures and health and safety of the work force and comply with the requirements of authorities having jurisdiction.

2. Comply fully with OSHA workplace safety requirements and regulations and those of other authorities having jurisdiction.

3. Provide and maintain OSHA-approved fall protection during erection of structural steel.

L. Responsibility for Errors: Accept responsibility for errors of detailing and fabrication and for the correct fit of the work.

M. Remedial Action: Promptly remove and replace materials, fabrications and workmanship found defective and provide new acceptable work in accordance with contract requirements. The expense of removing and replacing welds for testing purposes will be borne by SEPTA if welds are found satisfactory.

1.05 PROJECT CONDITIONS

A. Assume all risks for the protection of overhead or underground public utility and private lines, pipes, conduits and support work, existing structures, sidewalks, and property of whatever nature. Damage to such structures or to any persons or property associated with such structures, where such structure are or are not shown on the Drawings, is the responsibility of the Contractor. Pay for restoration of such structures back to original condition at no expense to SEPTA.

B. Field Measurements

1. Prior to commencement of the work, field-verify existing dimensions, elevations, locations and conditions applicable to the work. Report variances and discrepancies from the Contract Drawings and potential interferences promptly to the Project Manager.
2. Take sufficient field measurements prior to preparation of Shop Drawings and fabrication of construction materials, where possible, to ensure proper fitting of the work. However, do not delay job progress. Allow for adjustments and fitting wherever the taking of field measurements before fabrication may not be possible or might delay the work.

3. Actual field-verified conditions may require modifications to the fabrication and/or erection details indicated on the Contract Drawings. Perform the work to meet actual field conditions encountered.

1.06 DELIVERY, STORAGE AND HANDLING

A. Exercise care to avoid bending, scraping, and overstressing the steelwork. Block with wood or otherwise protect projecting parts likely to be bent or injured.

B. Mark weight on all members. Match-mark all shop pre-fitted members.

C. Ship small parts, such as rivets, 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 contents on the outside of each container.

D. Load, transport, unload, and store structural steel material in such a manner that the metal is kept clean and free from injury. Store material above ground on platforms, skids, or other supports, and cover and protect it from corrosion.

E. Identify materials by heat and lot, if applicable.

F. Replace pieces bent or damaged unless the Project Manager authorizes repairs.

PART 2– PRODUCTS

2.01 MATERIALS

A. Structural Steel: Provide structural steel in accordance with the following specifications as applicable and as indicated on the Contract Drawings.


2. Bridge Structural Steel (Weathering Steel):
   a. Structural Steel Shapes, Angles and Plates for the Bridge Superstructure: ASTM A709/A709M, Grade 50W.
   b. All new structural steel shapes, plates and bars shall be classified as Fracture Critical Members and meet temperature Zone 2 requirements with a minimum service temperature of -30°F.
   c. For weathering steel bolted connections, the faying surfaces shall have a one-coat paint system consisting of a high-quality air-drying rust-inhibitive shop-primer meeting AISC/RCSC slip resistance requirements. The primer shall be applied to a nominal dry film thickness of 1.5 to 2 mils. Additionally, limits on bolt spacing per AISC, AASHTO, and AREMA as applicable shall be followed. Plain or galvanized bolts should not be used in weathering steel connections.

3. Bridge Structural Steel (with Corrosion Protection and Paint System):
   a. Structural Steel Shapes, Angles and Plates for the Bridge Superstructure: ASTM A572 Grade 50 or ASTM A992 Steel with approved paint system.
   b. Refer to SEPTA Structural Design Criteria and Guidelines Chapter 9 Section 5 for corrosion protection and paint system requirements.
c. All new structural steel shapes, plates and bars shall be classified as Fracture Critical Members and meet temperature Zone 2 requirements with a minimum service temperature of -30°F.
d. Bolts: ASTM325

4. Structural Steel for Other Structures:
   a. Wide Flange W-Shapes: ASTM A992 or ASTM A572 Grade 50.
   c. Steel Pipe: ASTM A53, Type E or S, Grade B, Schedule 80, extra strong (XX) or double extra strong (XXX) weight as indicated, hot-dip galvanized in accordance with ASTM A123.
   d. Rectangular or Square Tubing: ASTM A618, Structural Grade (Fy = 50 ksi).
   e. All new bridge structural steel shall be hot-dip galvanized in accordance with ASTM A123 unless otherwise noted.

B. All members shall be furnished full length without splices unless otherwise noted or accepted by the Project Manager. Proposed girder splice locations and details shall be submitted to the Project Manager for review and approval.

C. All temporary structural steel members shall conform to ASTM A709 Grade 50 unless otherwise specified herein or shown or noted on the Contract Drawings.

2.02 FASTENERS

A. General: All carbon steel fasteners shall be hot-dip galvanized unless otherwise noted. Furnish bolts, nuts and washers for a given grade and diameter of bolt from a single domestic manufacturer. For each diameter, only one grade may be used. Ship bolting materials to the job site in the bolt manufacturer’s unopened containers with nuts and washers assembled and lot numbers marked on the container.

B. Provide bolts and nuts that conform to applicable dimensional requirements of ANSI B18.2.1 for bolts and B18.2.2 for nuts.

C. High Strength Bolts: Provide high-strength bolts conforming to the requirements of ASTM A325, Type 1, plain, for all bolted structural joints except where standard bolts conforming to ASTM A307 are specifically indicated or permitted on the Contract Drawings.

D. Nuts: Nuts for ASTM A325 bolts shall conform to ASTM A563, Grade C, D, or DH or ASTM A194, Grade 2 or 2H.

E. Washers: Hardened washers shall conform to ASTM F436 and the requirements of the Specification for Structural Joints Using ASTM A325 or A490 Bolts.

F. Direct Tension Indicators: Compression-washer-type, direct tension indicators conforming to ASTM F959.


H. Round washers, (other than those in contact with high-strength bolt heads and nuts): Provide round washers in accordance with ANSI B18.22.1.

I. Beveled Washers (other than those in contact with high-strength bolt heads and nuts): Provide square, smooth and sloped washers to make contact surface of bolt head and nut parallel.
J. Anchor Bolts: Provide non-headed anchor bolts meeting the requirements of ASTM A36 or ASTM A307, hot-dip galvanized, either bent or straight and of the diameter and length as indicated on the Contract Drawings. Use ASTM A36 swedge anchor bolts where indicated on the Contract Drawings. Use ASTM F1554, Grade 105 swaged anchor bolts for the bearing assemblies. Galvanize anchor bolts, rods, nuts and washers under the supervision of the bolt manufacturer in accordance with ASTM A153, Class C.

K. Headed Anchors (Welded Shear Studs): Provide weldable, uncoated headed anchors meeting the requirements of A108 in accordance with ANSI/AWS D1.1, of the diameter and length shown on the Contract Drawings.

L. Lubricant for Bolts: Provide molybdenum disulfide base lubricant for bolts.

2.03 WELDING ELECTRODES

A. No field welding will be permitted except for shear studs welding.

B. Use E70XX electrodes in conformance with AWS Code.

C. For shop and field welding, use low hydrogen E70XX electrodes.

D. Use E316 electrodes for welding Type 316 stainless steel base metal.

E. Use E308 electrodes for welding Type 304 stainless steel base metal.

2.04 POST-INSTALLED ANCHORS

A. Chemical Adhesive Anchors: Provide chemical adhesive anchors, compliant and certified for use in accordance with 2009 International Building Code requirements, consisting of a stud-type, all-thread anchor rod, nut and washer, manufactured from AISI 304 stainless steel, and a two-part vinyl ester or structural epoxy resin adhesive and an amine-based hardener.

1. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
   a. Epcon G5 Adhesive Anchoring System, ITW Red Head, Addison, IL.
   b. HVA Capsule Adhesive Anchoring System, Hilti, Inc., Tulsa, OK.
   c. Set-XP Epoxy-Tie, Simpson-Strong Tie Anchor Systems, Columbus, OH.
   d. Or approved equal.

B. Mechanical Expansion Anchors: Provide wedge-type mechanical expansion anchors, compliant and certified for use in accordance with 2009 International Building Code requirements, manufactured from AISI 304 stainless steel meeting the requirements of Fed. Spec. A-A-1923 (formerly FF-S-325, Group II). Anchor may be headed, threaded or countersunk depending on intended use.

1. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
   a. HDA-P Undercut Anchor, Hilti, Inc., Tulsa, OK.
   b. TruBolt Wedge Anchors, ITW Red Head, Addison, IL.
   c. Strong Bolt, Simpson-Strong Tie Anchor Systems, Columbus, OH.
   d. Or approved equal.

2.05 NON-SHRINK GROUT

A. Provide non-shrink, non-metallic grout in accordance with the provisions of Section 03300 – Cast-in-Place Concrete.
2.06 EXTERIOR HIGH PERFORMANCE COATING SYSTEMS
   A. Provide a high performance, three-coat paint system for exterior ferrous metal surfaces of the steel bridge components as specified in Specification Section 09900.
   B. Exterior ferrous metal surfaces to be galvanized shall not be painted.

2.07 GALVANIZING REPAIR PAINT (COLD GALVANIZING)
   A. Provide high zinc-dust/zinc oxide content paint for repair of damaged galvanized surfaces and field touch-up of welds that meets the following requirements:
      1. One application shall provide a minimum dry coating thickness of 2.0 mils.
      2. Dried film shall have a minimum zinc dust content equal to 94% by weight.
      3. The applied coating shall provide barrier protection and be anodic to steel.
      4. The coating may be applied under both shop and field conditions.
      5. The product used shall be approved by the galvanizer and shall be compatible with the galvanized surfaces and inert in concrete.
   B. Acceptable Products/Manufacturers: Subject to compliance with requirements, provide one of the following:
      1. ZRC, Z.R.C. Worldwide, Quincy, MA.
      2. Zinc Clad; Sherwin Williams, Cleveland, OH.
      3. Or approved equal.

2.08 FABRICATION
   A. Suppliers
      1. Any manufacturer approved by the American Institute of Steel Construction (AISC) and PennDOT will be qualified for steel fabrication as specified in this Section.
      2. For Producers of Fabricated Structural Steel, PennDOT accepts material supplied from any Steel Mill as long as the material complies with the requirements of Publication 408, Section 106, "Control of Material".
      3. Use or furnish only steel products produced in the United States in the performance of the contract or any subcontract.
   B. General
      1. The fabricator shall provide an affidavit stating that the structural steel furnished meets the requirements of the grade specified. All unidentified steel will be rejected and shall be removed from the site and replaced by the Contractor, at no additional cost to SEPTA.
      2. Fabricate and shop-assemble work in accordance with the following:
      3. Members shall be straight and shall fit closely together. The finished work shall be free from burrs, twists, bends, open joints and other imperfections.
   C. Bridges Structures
1. Fabricate bearing stiffeners and stiffeners intended as supports for concentrated loads to have full bearing on the flanges. Mill or grind bearing surfaces of these stiffeners or provide complete penetration welds at bearing surfaces as indicated on the Contract Drawings.

2. Bend load-carrying cold-rolled steel plates cold, at right angles to the direction of rolling. The radius of the bend shall be in accordance with AISC Manual of Steel Construction.

3. Machine finish all metal surfaces of the indicated bearing components in accordance with ANSI B46.1 as follows:
   a. Underside of masonry plate in contact with grout: ANSI 500 roughness value.

4. Where sole plates are shop welded to girder flanges, the underside of the sole plate shall be planed or straightened after being welded to the girder flange to remove distortion and warping of the sole plate resulting from welding operations.

5. Connections:
   a. Except where welded or ASTM A307 bolted connections are shown, use galvanized ASTM A325-SC bolts (slip critical) for shop connections.
   b. Unless otherwise shown, bolt field connections using galvanized ASTM A325-SC bolts (slip critical) in accordance with AREMA Manual for Railway Engineering, Chapter 15, Part 3.
   c. Galvanized bolts nuts and washers shall be considered as manufactured assemblies and shipped together in the same container. Each galvanized bolt and galvanized nut intended to be used with the bolt shall be assembled in a steel joint with a galvanized washer and tested in accordance with applicable provisions of AREMA Manual for Railway Engineering, Chapter 15, Section 3.2, Article 3.2.14.
   d. Galvanized faying surfaces of slip-critical connections shall be visibly dulled by wire brushing or light blast cleaning, without disrupting the continuity of the galvanized coating, prior to installing high-strength bolts.
   e. Perform all welding in accordance with AREMA Manual for Railway Engineering, Chapter 15, Part 3.
   f. Bolting: Perform all bolting in accordance with AREMA Manual for Railway Engineering, Chapter 15, Part 3. All bolts shall be tensioned as per Table 15-3-2 of AREMA 2008 Manual for Railway Engineering.

D. Other Steel Structures

1. Connection Design:
   a. Connections for beams, girders, and columns shall be designed for the reaction values noted on the Contract Drawings, where indicated.
   b. Wherever beam reaction values or connection details are not shown, design the minimum connection to support one-half (50%) of the total uniform load capacity tabulated in the AISC tables for allowable loads for laterally supported beams for the given shape, span, and steel specified for the beam in question.
   c. Where the number of bolts is not indicated, connections shall be full depth.
   d. Design of structural steel connections for which connection details or beam reaction values are not shown on the Contract Drawings shall be prepared under the supervision of a licensed Professional Engineer registered in the Commonwealth of Pennsylvania.
2. Use high-strength bolted connections of the size and type indicated on the Contract Drawings. Use beveled washers against sloping flanges. Contact joint surfaces of friction-type bolted connections shall be free of oil, lacquer or other contaminant.

3. Bolted connections for secondary members (such as girts and stair framing) may be made with 3/4-inch diameter machine bolts conforming to ASTM A307.

4. Gusset plates and connection angles shall be 3/8" minimum in thickness.

5. Beam-splice connections are not permitted unless shown on the Contract Drawings.

6. Where a beam connection is required to carry moment, design the connection for the allowable moment capacity of the smallest connected member.

7. Use steel plate washers for oversized, short-slotted and long-slotted holes in accordance with the requirements of the Specification for Structural Joints Using ASTM A325 or A490 Bolts.

8. Bracing connections shall have a minimum of two bolts or the equivalent in weld strength unless otherwise shown on the Contract Drawings or approved Shop Drawings.

9. Bearing stiffeners and stiffeners intended to support concentrated loads shall have full bearing on flanges to which they transmit the receive load. Mill or grind stiffener bearing surfaces. On weldable steel in compression areas of flanges, stiffeners may be welded as indicated. Stiffeners not located at points of concentrated loads shall be tight to that degree which will exclude water after being painted, unless otherwise indicated.

10. Plane sheared edges of plates thicker than 5/8" and carrying calculated stress to a depth of 1/4". If so indicated, face abutted joints and bring those joints to an even bearing. Build floor beams, stringers, and girders having end connection angles to exact length, back-to-back, of connection angles. If end connections are faced, finished thickness of angle shall be not thinner than that indicated. Machine-flatten metal bearing surfaces which will contact cement mortar grout to within 1/8" tolerance in 1" and to within 3/16" overall.

11. Welding: Perform welding in accordance with ANSI/AWS D1.1/D1.1M except as modified herein.
   a. Field welding of structural steel is not permitted with the exception of shear studs which may be field welded.
   b. Perform procedure and sequence of welding so as to avoid unnecessary distortion and minimize stresses. Straighten transverse warpage of flanges if necessary by controlled heating along outside face.
   c. Make allowance in shop for expected weld shrinkage in lying out and assembling members. Trim members to size only when most or all of welding has been completed.
   d. Repair defective welds by chipping or melting out such defects from one or more sides of joint as required removing only weld metal necessary to correct defect. Re-weld and have weld tested, as directed by the Project Manager, at no additional cost to SEPTA.

12. Mill or saw cut columns at bearing ends. Protect surfaces of bearing ends from corrosion. Holes in column base plates shall be 5/16" larger diameter than bolt size to allow for field adjustment unless otherwise indicated on the Contract Drawings.
13. Provide holes in structural steel members required for anchors, anchor bolts, bolt holes, connection angles, supports and braces for stair stringers, equipment apparatus, sag rods, or other members noted on the Contract Drawings shall be provided by the fabricator and detailed on the Shop Drawings.

14. Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, where indicated on the Contract Drawings. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

15. Provide slotted or oversized holes in framing members where indicated on the Contract Drawings or where required to facilitate steel erection. Hole sizes and slot lengths shall conform to AISC standards.

16. Where shop assembly of field connections is shown, specified or required, the unmatched holes shall be reamed and the pieces match-marked before disassembly. The interchange of matching parts will not be permitted.

2.09 PROTECTIVE COATINGS, SHOP APPLIED

A. Examination: At the request of SEPTA, provide access and pay all costs for the Project Manager or designated representative to visit the fabricator’s facility to inspect fabricated structural steel immediately prior to initial shop galvanizing or painting operations.

B. Surface Preparation: After fabrication and prior to galvanizing where applicable, clean structural steel to be galvanized or painted by removing loose rust, loose mill scale, and spatter, slag or flux deposits. Clean structural steel prior to galvanizing or painting in accordance with SSPC-SP10/NACE No. 2.

C. Galvanizing

1. Except as otherwise specified herein, hot-dip galvanize structural steel components after fabrication in accordance with ASTM A123 or ASTM A153, as applicable, unless otherwise specified herein or indicated on the Contract Drawings.

2. Fabricate products either complete or in largest practical sections before galvanizing. Weight of zinc coating shall be Coating Grade 85 (2.0 oz. per square foot) as specified in ASTM A123, Section 6.

3. Do not galvanize stainless steel elements or components of the bridge bearing assemblies.

4. Coordinate with the galvanizer to locate and provide adequately sized drainage holes for welded assemblies as required.

5. Portions of steel surfaces to be machined or field welded shall be masked off to exclude galvanizing.

6. Galvanized steel surfaces shall not be painted unless otherwise shown or specified.

D. Shop Painting

1. Paint all superstructure (weathering) steel within a distance of 1 1/2 times the depth of girder from bridge joints. Paint all weathering steel catenary structures within the bottom two (2) feet.

2. Perform primer painting in the fabrication shop in accordance with the requirements specified herein and in compliance with paint manufacturer’s written instructions.

3. Prime paint structural steel in the fabrication shop as follows:
a. Immediately after surface preparation, apply structural steel primer paint. Provide written assurance from the primer manufacturer that the selected primer paint is compatible with surfaces of galvanized steel.

b. Steel surfaces to be machined or welded shall be masked off to exclude paint including overspray and shall not receive primer paint.

c. Primer paint may be applied to uncoated faying surfaces (i.e. contact surfaces) at high-strength bolted with slip-critical (friction-type) connections provided that the coating is certified to provide a Class A or Class B faying surface in accordance with the test method adopted by the Research Council on Structural Connections (RCSC) as presented in the “Specification for Structural Joints Using ASTM A325 or A490 Bolts.”

1) Section 5.4 of the RCSC specification defines a Class A faying surface as an uncoated clean mill steel surface or blast-cleaned steel surface protected by a Class A coating with a coefficient of friction not less than 0.33.

2) A Class B faying surface is similarly defined as an uncoated blast-cleaned steel surface or a surface protected by a Class B coating on blast-cleaned steel with a coefficient of friction not less than 0.50.

d. If coating requirements of sub-paragraph 3.2.D.2.c above cannot be met, faying surfaces at slip-critical connections shall be masked off to exclude paint including inadvertent overspray. Uncoated faying surfaces shall be free of scale, except tight mill scale, and free of coatings in areas closer than one bolt diameter but not less than one inch from the edge of any hole and in all areas within the bolt pattern.

e. Stainless steel shall not be primed or painted.

f. Use painting methods that result in full coverage of joints, corners, edges and exposed surfaces. Do not exceed specified thickness.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Field welding of or to any primary structural steel is not permitted with the exception of shear studs which may be field welded.

B. Examine the areas and conditions under which structural steel is to be installed and notify the Project Manager promptly in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not proceed with the work until disputed conditions, discrepancies and/or damages have been corrected, unless otherwise directed by the Project Manager.

3.02 ERECTION

A. Erection shall be in accordance with the Contract Documents, approved Shop and Working Drawings and the following publications:

1. Bridge Structures: AREMA Manual for Railway Engineering, Chapter 15, Part 4, except Section 4.9 shall be deleted.

B. Report any damage caused during erection to the Project Manager. Complete corrective measures as directed by the Project Manager at no cost to SEPTA.

C. Do not place temporary erection loads or permanent loads on any incomplete portions of the structure being erected unless it can be demonstrated by analysis in writing that the contemplated action is safe.

D. Keep loose timbers, metal sheeting, bolt buckles, tools, debris, and temporary scaffolding restrained or removed from work areas. Assume responsibility for securing all equipment and materials within the steel erector’s care, custody, and control during the erection operation.

E. Maintain the job site in clean and safe condition at all times and properly dispose of, off premises, all crating, waste materials, and other refuse which has accumulated as a result of erection activities.

F. Perform lifting of painted structural members with a non-abrasive choker to avoid damage to finished surfaces.

G. Keep a daily record, by piece number, of all structural steel material erected.

H. Before commencing work, check foundations and other connection points to confirm their location, orientation, elevation, and condition.

I. Anchor Bolts
   1. All anchor bolts for structural steel erection and other incidental structural steel items required to be built into concrete substructure shall be properly set and securely held in position in the forms before the concrete is placed.
   2. Install anchor bolts accurately in position as shown on the approved erection drawings within the permissible dimensional variations given in the AISC Code of Standard Practice.
   3. If anchor bolts are cast in concrete substructure when it is being constructed, ensure that they are firmly held in their correct position and elevation by suitable templates. Set anchor bolts accurately to the template to provide suitable projection above concrete and/or grout as specified in the AISC Code of Standard Practice. Set anchor bolts perpendicular to the theoretical bearing surface.
   4. If approval is given to install anchor bolts in preformed holes or in drilled holes in concrete or masonry, use approved epoxy resin product as specified in Section 03300 – Cast-in-Place Concrete for securing them in place.
   5. Where misalignment between anchor bolts and bolt holes in steel members is encountered, notify the Project Manager immediately. Submit a method to remedy the misalignment for review and approval by the Project Manager.
   6. Set anchor bolts to template or in preformed holes. Do not drill unless specifically indicated on plans. Fill the preformed holes with non-shrink grout. Fill the clearance between anchor bolts and holes in masonry plates with approved non-hardening caulking compound conforming to Publication 408, Section 705.8.

J. Align column bases with leveling nut and steel shims as required. Shim bearing plates for beams and similar structural members with steel wedges or shims. Allowable deviation from a true horizontal plane shall not exceed 1/8” in 12 inches. After the supported members have been aligned and properly positioned and the anchor nuts have been tightened, fill the entire area under bearing plates with non-shrink grout material as specified in Section 03300 – Cast-in-Place Concrete. Follow written procedures of the grout manufacturer.

K. Erect steel structures true and plumb following the match marks. Individual column shipping pieces will be considered plumb if the deviation of the working line does not exceed 1 in 500 over the length of the piece.
L. Use temporary supports and bracing to stabilize the structure against construction loads and all external imposed loads to which the structure may be subjected, including those from erection equipment or the operation of same as specified in Section 01500. Leave temporary supports and bracing in place as long as may be required for safety and, in any case, until all structural framing members are permanently installed.

M. Misfits at Bolted Connections
   1. Where misfits in erection bolting are encountered, notify the Project Manager immediately. Submit a method to remedy the misfit for review by the Project Manager. The Project Manager will determine whether the remedy is acceptable or if the member is required to be replaced or refabricated.
   2. Incorrectly sized or misaligned holes in members shall not be enlarged by burning or by the use of drift pins. Notify the Project Manager immediately and submit a proposed method of remedy for review by the Project Manager.

N. Field Assembly
   1. All materials shall be properly worked and match-marked for field assembly. Where finishing is required, complete assembly including bolting and welding of units before start of finishing operations.
   2. Splice only where indicated on the approved Shop Drawings.
   3. Align and adjust members forming parts of a complete assembly after assembly and before fastening.
   4. Thoroughly clean surfaces to be joined together.
   5. Fasten splices of compression members after the abutting surfaces have been brought completely into contact.
   6. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   7. All field connections shall be accurately fitted up before being bolted. Limit drifting only to the extent that will bring the parts into position and not cause enlargement of the holes or distortion of the metal. Drill or ream all unfair holes.

O. Report immediately to the Project Manager errors in shop fabrication or deformation resulting from handling or transportation that prevent the proper erection and fitting of parts.

P. Grouting of Base Plates and Bearing Plates: All loose column base plates and billets shall be accurately set to the designated levels on steel wedges or angle screeds in preparation for grouting.
   1. Prior to the placement of non-shrink grout beneath base and bearing plates, clean the bottom surface of the plates of all foreign materials, and clean concrete and masonry bearing surfaces of all foreign materials and roughen surface to improve bonding.
   2. Tighten anchor bolts after the supported members have been positioned and plumbed and the non-shrink grout has attained its specified strength.
   3. Grout base plates with non-shrink grout to assure full uniform bearing. Perform grouting prior to placing loads on the structure.

Q. As erection progresses, perform sufficient bolting of the work to support dead load, wind load and erection loads. Perform permanent bolting when final alignment is completed.

R. Ensure that holes are not enlarged and that the drifting done during assembly does not disturb the metal in the vicinity of the holes.
S. Enlarge holes to admit bolts for connections only if approved by the Project Manager. Make the enlargement by reaming and not by burning. Avoid hand reaming. No holes to accommodate bolts shall be burned through in the field.

T. Do not weld main stress members in the field with the exception that field welding for shear studs is permitted and shall use low hydrogen electrodes.

U. Bolted Connections
   1. Install high-strength bolts in accordance with the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
   2. Use indicator washers as the approved direct tension indicator at the Contractor’s option. Direct tension indicator washers shall be installed according to the manufacturer’s published specifications.
   3. Do not inter-mix mechanically galvanized bolts and nuts with hot-dip galvanized nuts and bolts.
   4. Color code, die punch, or otherwise mark the ends of torqued bolts indicating that the bolts have been properly tensioned and are ready for inspection.

V. Welded Connections
   1. Weld in accordance with ANSI/AWS D1.5/D1.5M, except as modified herein. Bolts for temporarily fastening welded splices and welded connections shall be either tightened securely and left in place or removed and the holes filled with high strength bolts and fully torqued. If left in place, burn off the portion of the bolt which projects beyond the nut. If the bolt does not project beyond the nut, tack weld the end of the bolt to the nut. Burn off and tack weld before painting. Location and number of welded splices shall be as indicated on the Contract Drawings or on approved Shop Drawings.
   2. Make all welds continuous unless alternate welding procedures are shown on the approved Shop Drawings.
   3. Field welds, with the exception of shear studs, will not be permitted unless otherwise authorized in writing by the Project Manager or designee.
   4. Field Welds: Surfaces within 2 inches of any field weld location shall be free of materials that would prevent proper welding or produce objectionable fumes while welding is being done.

W. Post-installed Anchor Installation: Install chemical adhesive anchors in accordance with the manufacturer’s written instructions for all hole orientations except overhead installations. Install mechanical expansion anchors for overhead installations in accordance with the manufacturer's written instructions.

3.03 FIELD PAINTING

A. Intermediate Coat: Apply intermediate coat in the field in accordance with manufacturer's instructions to primed surfaces.
   1. Paint steel surfaces to be painted except those to be machined, welded or high-strength bolted with slip-critical (friction-type) connections.
   2. Mask the entire faying surface between parts at high strength bolted connections to prevent overspray of intermediate coat onto primed faying surfaces.
   3. Use painting methods that result in full coverage of joints, corners, edges and exposed surfaces. Do not exceed specified thickness.

B. Top Coat: Apply top coat in the field in accordance with manufacturer's instructions to painted surfaces.
1. Use painting methods that result in full coverage of joints, corners, edges and exposed surfaces. Do not exceed specified thickness.

2. Touch up field painted surfaces in the field that have been damaged during handling or erection, and exposed surfaces of fasteners and field welds, with specified shop primer and top coat.

3.04 FIELD QUALITY CONTROL

A. The Testing and Inspection Agency will inspect all field-assembled bolted construction in accordance with Section 9 of the "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

B. Bridge Structures: The Testing and Inspection Agency will inspect and test welds of main load-carrying members utilized in Non-Fracture Critical applications in accordance with AREMA Manual for Railway Engineering, Chapter 13, Article 3.5.5.c, "T" material as follows:

1. At least 25% of flange-to-web fillet welds will be inspected and tested.
2. At least 25% of stiffener/connection plate-to-flange/web fillet welds will be inspected and tested.
3. All full penetration welds for bearing stiffeners and girder flange splices will be inspected and tested.

C. Other Steel Structures: The Testing and Inspection Agency will visually inspect all field welds for shear studs, except puddle welds, and test ten (10) percent of all field welds by appropriate non-destructive testing method as described in AWS D1.1. Acceptance criteria shall be as defined in AWS D1.1.

D. Non-conforming Work

1. Repair or replace non-conforming structural steel work as directed by the Project Manager and at no additional cost to SEPTA.
2. Promptly remove and replace materials, fabrications and workmanship found defective and provide new acceptable work in accordance with contract requirements.
3. The expense of removing and replacing welds for testing purposes will be borne by SEPTA if welds are found satisfactory.

END OF SECTION 05120
PART 1 – GENERAL

1.01 DESCRIPTION
   A. This work is the construction of a protective barrier on bridges over electrified railroads.

1.02 RELATED SECTIONS
   A. Contract Agreement
   B. Division 1 - General Requirements
   C. Section 03400 – Concrete Barrier
   D. Section 16060 – Grounding and Bonding
   E. Section 09900 – Paints and Coatings

1.03 SUBMITTALS
   A. Submit the following in accordance with Section 01300:
      1. Shop drawings, showing fabrication and installation of aluminum protective barrier, including plans, elevations, sections, details of components and attachments to other units of work.
      2. Product data for galvanized aluminum products to be supplied from manufacturer.
      3. Structural computations or test data/evaluations, material properties and other information needed to ensure satisfactory structural compliance to applicable building codes to be supplied by the manufacturer – based on final fabrication drawings and documents.
      4. Final Verification: Qualification data for authorized manufacturers specified in "Quality Assurance" is to demonstrate their capabilities and experience. Include list of completed projects with project names and contact references.
      5. Welding Certificates.

1.04 QUALITY ASSURANCE
   A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
      1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
         a. PennDOT Publication 408, Specifications
         b. PennDOT Publication 35, Bulletin 15, Approved Construction Materials

PART 2– PRODUCTS

2.01 BARRIER
   A. Aluminum-Alloy Extruded Section—ASTM B 221/B 221M, Alloy 6061-T6 or 6351-T5.
   B. Aluminum-Alloy Sheet and Plate—Alloy 6061-T6
C. Aluminum-Alloy Bolts—ASTM B 211, Alloy 2024-T6 or 6061-T6
E. Nylon Washers—PennDOT Publication 408, Specifications, Section 1103.11(j)2
F. Bolt Heads—Regular hexagon. ANSI B18.2.3.5M (B18.2)
G. Nuts—Finished hexagon, ANSI B18.2.4.6M (B18.2) Thread, Class 6, 6g, or 6H (2, 2A, or 2B)
H. Other Aluminum Alloys—PennDOT Publication 408, Specifications, Section 1013.02(a)
I. Certify as specified in PennDOT Publication 408, Specifications, Section 106.03(b)3.

2.02 ANCHOR BOLTS, NUTS, AND WASHERS
A. See PennDOT Publication 408, Specifications, Section 1105.02(c)2, galvanized as specified in PennDOT Publication 408, Specifications, Section 1105.02(s).

2.03 CAULKING COMPOUND
A. See PennDOT Publication 408, Specifications, Section 705.8.

2.04 ACCIDENT PREVENTION SIGNS
A. Fabricate sign from aluminum and conform to Section 1103 of PennDOT Publication 408.
B. Mount sign with aluminum bolts, nuts, and washers which conform to Section 1103 of PennDOT Publication 408.
C. Mount signs 5-inches below top of fence and 9-inches from centerline of post. Do not space more than 50-feet apart.
D. See American National Standard Specifications for Accident Prevention Signs, ANSI Z535.1 thru ANSI Z535.5.

PART 3– EXECUTION

3.01 CONSTRUCTION
A. As shown on the Contract Drawings.
B. Final colors of Aluminum Protective Barrier, Federal Color Number #36373, in accordance with Section 09900.
C. Do not paint top horizontal surface of barrier.
D. Coat all surfaces in contact with concrete with caulking compound prior to erection. After erection and alignment, seal opening between the metal surfaces and the concrete with caulking compound.

END OF SECTION 05520
SECTION 05530
STEEL PICKET FENCE

PART 1 – GENERAL

1.1 DESCRIPTION
A. The work of this section consists of the furnishing and installation of steel picket fencing as shown on the contract drawing(s), and specified herein.

1.2 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 16060 – Grounding and Bonding.

1.3 CONTRACTOR RESPONSIBILITIES
A. Furnish all materials, tools, equipment, supervision, administration and transportation, and perform all labor and services necessary to supply and install estate fencing as described in the Specifications and indicated in the Contract Drawings.

1.4 REFERENCES
B. ADAAG - Americans with Disabilities Act Accessibility Guidelines
C. AISC - American Institute of Steel Construction - Manual of Steel Construction
D. ANSI - American National Standards Institute
   1. ANSI/AISC 350-05 - Specification for Structural Steel Buildings
   2. ANSI A117.1 - Accessible and Usable Buildings and Facilities
E. ASTM - American Society for Testing and Materials
   1. ASTM A53 - Grade B hot-dipped, zinc coated welded and seamless steel pipe
   2. ASTM A123 & A153 - Zinc-coating (hot dip) on assembled steel products and hardware
   3. ASTM A386 - Zinc-coating on assembled steel products
   4. ASTM A500 - Grade B cold formed welded and seamless carbon steel structural tubing
   5. ASTM A787 - Standard Specification for Electric-Resistance-Welded Metallic-Coated Carbon Steel Mechanical Tubing
   6. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   7. ASTM D6386 - Standard practice for preparation of zinc (hot-dip galvanized) coated iron and steel product and hardware surfaces for painting
   8. ASTM F2408 - Ornamental Fences Employing Galvanized Steel Tubular Pickets
   9. SSPC (Steel Structural Painting Council) - Structural Steel Painting Manual
F. AWS D1.1 - American Welding Society Standards
1.5 SUBMITTALS

A. The Contractor shall be responsible for coordinating all submittals. Submissions shall be complete and include all required submittals for each component of the fence. Individual submissions shall be returned for revision and any loss of time or additional costs are the Contractor's responsibility.

B. Submittals shall include the following:
   1. (3) copies of Shop (Fabrication/Installation) Drawings, made accurately to a scale sufficiently large to show all pertinent aspects of the item. Shop drawings shall be in the form of black line prints. Shop drawings shall include:
      a. Fence elevations at 1/2" scale min
      b. Full size section details of every typical composite members. Show anchors, hardware, trim and accessories which are not fully detailed in the manufacturer's standard data sheets.
      c. Typical baseplate mounting detail (if applicable)
      d. Hardware Schedule
   2. (3) copies of Manufacturer's Literature (Catalogue Cuts) for the following items:
      a. Fencing
      b. Finishes (including MSDS sheets)
      c. Fasteners
   3. (1) Material Sample of steel rail or picket showing galvanized and powder coated finish in black
   4. (3) copies of proposed Warranty, as described in section 1.05.

C. Review
   1. General: The Contractor shall provide to SEPTA the required submittals within the timeframe specified in the purchase order and after the Contractor's receipt of Notice To Proceed.
   2. One set of all submittals with review comments will be returned to the Contractor. The Contractor may make and distribute such copies as he or she deems necessary.
   3. Submittals shall be reviewed by SEPTA's Project Manager. The results of each submittal review shall have the following status stamp:
      - NO EXCEPTIONS TAKEN
      - PROCEED AS NOTED; REVISE AND RESUBMIT FOR RECORD
      - DO NOT PROCEED; REVISE AND RESUBMIT
      - REJECTED
      - NOT APPLICABLE
   4. Review and Processing shall not relieve the Contractor from responsibility for errors which may exist in the submitted data.
   5. Submittals not in compliance with the Contract will be returned to the Contractor for revision. Any loss of time and additional costs associated with resubmittal(s) shall be the Contractor's responsibility.
   6. Submittals that are marked "Proceed as Noted" are for the purpose of expediting procurement and/or fabrication of the intended work. The Contractor shall incorporate all corrections and resubmit to SEPTA within 10 working days the required copies of all submittals marked "Proceed as Noted."
   7. The Contractor shall allow 10 working days for review and processing by SEPTA following its receipt of the submittals.

1.6 WARRANTY

A. The contractor shall provide a twenty-year warranty on all finishes against finish failure, peeling and chipping.
PART 2 – PRODUCTS

2.1 ACCEPTABLE PRODUCTS AND MANUFACTURERS

A. Flat Top Fencing:
   1. Montage Plus in Majestic 3-Rail as manufactured by Ameristar Fence Products
   2. Aberdeen 3-Rail as manufactured by Iron World
   3. Westmoreland II in Mayfair 3-Rail as manufactured by Northeast Fence and Iron Works
   4. Or Approved Equal

B. Intrusion Prevention Fencing:
   1. Montage Commercial 3-Rail with Invincible Style Pickets as manufactured by Ameristar Fence Products
   2. Guardian 3-Rail with Bent Pickets as manufactured by Iron World
   3. Frankford Bent Top/Press Point Top 3-Rail as manufactured by Northeast Fence and Iron Works
   4. Or Approved Equal

2.2 COMPONENTS

A. Posts: Galvanized square steel tubular members, manufactured per ASTM A653 or A787, having 45,000 psi yield strength with a G90 zinc coating, .9oz/square ft, on interior and exterior of post.
   1. Posts for 4'-6" High Fencing:
      a. 2 ½" Square minimum
      b. 14 Gauge minimum
   2. End Posts and Corner Posts:
      c. 6" Square minimum
      d. 3/16" Wall minimum

B. Pickets: Galvanized square steel tubular members, manufactured per ASTM A653 or A787, having 45,000 yield strength with a G90 zinc coating, .9oz/square ft.
   1. Picket Size: ¾" x ¾"
   2. 16 gauge minimum
   3. Spaced 3 15/16" maximum between pickets.
   4. Pickets shall be inserted into pre-punched holes in the rails and shall be aligned to standard spacing using a calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by either a fusion welding process or industrial drive rivets painted to match fencing system.

C. Rails: Galvanized horizontal "U" channels, manufactured per ASTM A653, having a 50,000 psi yield strength with a G90 zinc coating, .9oz/square ft.
   1. Rail Size: 1 1/2" x 1 3/8"
   2. 14 Gauge minimum
   3. Rails to be mechanically punched to receive fasteners. Rails shall be attached to brackets using one-way stainless steel security fasteners.

D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for commercial weight fences under ASTM F2408.

2.3 ACCESSORIES

A. Rail/Post Brackets:
   1. 14 Gauge minimum
   2. Flat Mount Brackets with 300 series stainless steel tamper resistant bolts, of sufficient length to attach items in a secure non-rattling position. Fasteners to have a minimum
of 1,100 lbs holding power and a shear strength of 1,400 lbs. Fastener heads to be tamper resistant and painted to match panels.

B. Post Caps:
   1. Formed steel, weather tight, closure cap in style shown on drawing. Provide one for each post.

C. Base plates:
   1. 6” square minimum, ½” thick galvanized steel plate with (4) predrilled holes, manufactured per ASTM A653, with a G90 zinc coating, .9oz/square ft.
      a. Attach Base Plates to substrate with (4) stainless steel threaded rods set into epoxy fixative as suggested by manufacturer.

D. Accident Prevention Signs:
   1. Fabricate sign from aluminum and conform to PennDOT Publication 408, Specifications, Section 1103.
   2. Mount sign with aluminum bolts, nuts, and washers which conform to PennDOT Publication 408, Specifications, Section 1103.
   3. Mount signs 5-inches below top of fence and 9-inches from centerline of post. Do not space more than 50-feet apart.

2.4 FINISH

A. All parts of the fence including panels, posts and rails shall receive a powder coating process per Division 9 Specifications for Powder Coating. All finishes shall be warranted for 20 years.

2.5 PACKAGING AND SHIPPING

A. All components shall be packaged, shipped and stored so as to protect the integrity and finish from any damage.
B. Delivery of all materials shall be made at one time.
C. Delivery shall be arranged at SEPTA’s work site only when the site is ready with suitable space for storage and provisions to protect materials during construction.

PART 3 – EXECUTION

3.1 DELIVERY AND INSPECTION

A. All materials/fabrications shall be protected during shipping from physical damage. Each shall be individually wrapped and braced to protect from scratching, racking, etc.
B. Store materials off of ground on pallets. Cover and provide for air circulation. Protect from damage and ongoing construction operations.

3.2 INSTALLATION
A. Install fence per industry standard and manufacturer’s guidelines.

B. Base Plate Mounting: Anchor base plates to concrete sidewalk or curbing with four stainless steel threaded rods set in Hilti RE-Hit Injection Epoxy system or approved equal. Size rods appropriately to securely anchor fence posts and to support fence sections. Provide stainless steel nuts and washers and install with Lock-Tight. Install neoprene washer between base plate and stainless steel washer. Install neoprene shim between concrete substrate and base plate.

C. Check each post for vertical and top alignment.

D. Install and secure post tops with rivets.

3.3 FINAL CLEANING

A. Touch up any areas that were damaged or scratched during installation.

B. Clean off all surfaces of any dust or construction debris.

C. Clean up any debris from installation and remove from site.

END OF SECTION
SECTION 05540
PROTECTIVE FENCE AND GATE

PART 1 – GENERAL

1.01 DESCRIPTION
A. This work is the construction of barrier protective fences, sidewalk protective fences and gates.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 - General Requirements

1.03 SUBMITTALS
A. Before fabrication, submit shop drawings for review and acceptance.

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications
      b. PennDOT Publication 35, Bulletin 15, Approved Construction Materials

PART 2– PRODUCTS

2.01 PROTECTIVE FENCE (STEEL).
A. Fabric: See PennDOT Publication 408, Specifications, Section 1110.01(a), size of mesh, 1 inch.
B. Fabric Tie Wire: No. 9 gage aluminum wire; or No. 9 gage steel wire, galvanized, conforming to ASTM F 626, or aluminized, conforming to ASTM A 491. Certify as specified in PennDOT Publication 408, Specifications, Section 106.03(b)3.
C. Posts, Rails, and Fittings: End, corner, and line posts; top and bottom rails; and brace rails to be Heavy Industrial Steel Fence Pipe ASTM F 1043 Grade IC (344 MPa (50,000 pounds per square inch) minimum yield strength) with plain ends. Substitution of High Strength ASTM F 1083 Grade 83000 ((83,000 pounds per square inch) yield strength) Schedule 40 pipe is allowed at no additional cost to the Department. Fittings and hardware as specified in PennDOT Publication 408, Specifications, Section 1110.02(a). Certify as specified in PennDOT Publication 408, Specifications, Section 106.03(b)3.
D. Anchor Bolts, Nuts, and Washers: See PennDOT Publication 408, Specifications, Section 1105.02(c)2, galvanized as specified in PennDOT Publication 408, Specifications, Section 1105.02(s).
E. Caulking Compound: See PennDOT Publication 408, Specifications, Section 705.8
F. Gates: As shown on the PennDOT Standard Drawings RC-61M and as follows:
   1. Swing-type gates, with latches, stops, keepers, hinges, and locks.
2. Steel wire fabric of same type material as the fence.
3. Hinges of adequate strength to support the gate, and that do not twist or turn under the gate's action.
4. Plungebar-type latches that can be locked, full gate height, and located in a manner that engages the gate stop.
5. Forked latches may be allowed, for single gates less than 10 feet wide.
6. Stops are to consist of a flush plate, anchored in concrete, to engage the plungebar of the latch.
7. Other types of stops may be allowed, for single gates less than 10 feet wide.
8. Substantial devices are necessary for securing and supporting the free end of the gate in an open position.

PART 3– EXECUTION

3.01 CONSTRUCTION

As shown on the PennDOT Standard Drawings and as follows:

A. General

1. Fasten fabric to the line posts, top, bottom and intermediate rail if required, and brace rails, using tie wires spaced not more than 600 mm (24 inches) apart; fasten to end and corner posts using 5 mm x 10 mm (3/16-inch by 3/8-inch) stretcher bar bands. Use stretcher bars with square edges attached by threading through the fabric, attached with clamps, or attached by other positive mechanical means.

2. Use brace bands and stretcher bar bands (1/8 inch by 1 inch), with (3/8-inch) diameter by (1 1/2 inches) long, non-removable bolts.

3. Do not use bent or damaged posts or rails. Place moisture-proof post tops. Position line-post tops to pass the top rail through the post tops.

4. Place top rails in (20-foot) lengths, with couplings or expansion devices joining the lengths to form a continuous brace for each stretch of fence. Fasten top rails to end and corner posts by means of rail ends and brace bands.

5. Use brace rails at end and corner posts, midway between the top and bottom rail, extending from the end or corner post to the adjacent line posts.

6. Use intermediate rail for 7'-8" fence panels only.

7. Fasten bottom rails and brace rails to end, to corner, and to line posts, using rail ends, brace ends, and brace bands.

8. Place truss rods, (3/8 inch) in diameter, with turnbuckles, between the brace ends of the brace rail and the bottom rail.

B. Steel Welding: According to AWS.

END OF SECTION 05540
SECTION 05610
NEOPRENE BEARING PADS

PART 1– GENERAL

1.01 DESCRIPTION

A. This work is the fabrication, furnishing, transportation, and delivery of plain and laminated neoprene bearing pads.
   1. Unreinforced Pads. Elastomeric bearing pads consisting of elastomer only.

1.02 RELATED SECTIONS

A. Contract Agreement
B. Division 1 - General Requirements

1.03 SUBMITTALS

A. Submit the following in accordance with Section 01300:
   1. Manufacturer's Data: Submit manufacturer's specifications, test reports and installation instructions for all proposed materials, products and accessories.
   2. Shop Drawings that depict all shop and erection details and schedules for fabrication and shop assembly.
   3. Design Calculations: Submit for review structural design calculations. Calculations shall be prepared under the direct supervision of, and signed and sealed by, a licensed Professional Engineer registered in the Commonwealth of Pennsylvania and experienced in the structural design of bearing pads.

1.04 QUALITY ASSURANCE

A. Furnish bearings with the dimensions, material properties, elastomer grades, and laminate types indicated.
C. Certification: Provide the manufacturer's certification that each bearing satisfies the requirements of the plans and these Specifications. Provide a certified copy of the material test results.

PART 2– PRODUCTS

2.01 MATERIALS

A. Elastomer
1. Furnish virgin Neoprene (polychloroprene) elastomer. Provide low temperature grade 0, 2, 3, 4, or 5 elastomer compound. Elastomer compound grades are defined by the testing requirements in Table A. Substitution of a higher grade of elastomer for a lower one is permissible.

2. Provide elastomer compound conforming to Table A unless otherwise directed. Interpolate test requirements for intermediate hardnesses. If the material is specified by its shear modulus, furnish material with a measured shear modulus that is within 15% of the specified value. For the purpose of defining limits for the tests in Table A, supply material with a consistent value of hardness. If the material is specified by its hardness, furnish material with a measured shear modulus that conforms to Table 14.7.5.2-1 of the LRFD Specification. When test specimens are cut from the finished product, the physical properties are allowed to vary from those specified in Table A by 10%. Conduct all material tests at 73°F ± 4°F unless otherwise noted. Conduct shear modulus tests according to Annex A of ASTM D 4014.

B. Steel Laminates
1. Fabricate steel laminates used for reinforcement from rolled mild steel conforming to ASTM A 36/A 36M, ASTM A 1011, or equivalent, unless otherwise directed. Furnish laminates with a minimum nominal thickness of 16 gage. Do not make holes in plates for manufacturing purposes unless indicated.

C. Fabric Reinforcement
1. Weave fabric reinforcement from 100% glass fibers of —E—with continuous fibers. Provide a minimum thread count in either direction of ten threads per 25 threads per inch. Furnish fabric having either a crowfoot or an 8 Hardness Satin weave. Ensure each ply of fabric has a minimum breaking strength of 800 pounds per inch in each thread direction. Holes in the fabric are not allowed.

D. Bond
1. Provide a vulcanized bond between the fabric reinforcement and elastomer with a minimum peel strength of 30 pounds per inch. Supply steel laminated bearings that develop a minimum peel strength of 40 pounds per inch. Perform peel strength tests according to ASTM D 429, Method B.

2.02 FABRICATION
A. Laminated Pads with Steel Reinforcement: Cast laminated bearings pads with steel reinforcement as a unit in a mold. Bond and vulcanize bearings under heat and pressure. Ensure that the mold finish conforms to standard shop practice. Sand blast and clean the internal steel laminates to remove all surface coatings, rust, mill scale, and dirt before bonding, and ensure that the internal steel laminates are free of sharp edges and burrs. For bearings that are designed to act as a single unit with a given shape factor, manufacture the bearings as single units. Repair all cavities left in the edges of the pad from the manufacturing process by in-plant vulcanizing with neoprene material from the same lot as the bearing pad.

B. Laminated Pads with Fabric Reinforcement: Vulcanize fabric-reinforced bearings in large sheets and cut to size. Perform cutting in such a way to avoid heating the materials and to produce a smooth finish with no separation of the fabric from the elastomer. Furnish at least single ply fabric reinforcement for the top and bottom reinforcement layers and double ply for internal reinforcement layers. Place fabric parallel to the top and bottom surfaces. Ensure that the fabric is free of folds and ripples.
C. Plain Pads: Mold, extrude, or vulcanize plain pads in large sheets and cut to size. Ensure that cutting does not heat the material, but produces a smooth finish.

D. Marking: Provide the manufacturer's certification that each bearing satisfies the requirements of the plans and these Specifications. Provide a certified copy of the material test results. Mark each reinforced bearing in indelible ink or flexible paint. Include the orientation, the order number, lot number, bearing identification number, and elastomer type and grade number in the marking. Unless otherwise specified in the contract documents, place the marking on the face that is visible after erection of the bridge.

E. Testing: Sample the completed pads according to PTM No. 312.

1. Scope. Test materials for elastomeric bearings and finished bearings according to Table A and as specified below.

**Table A**

**Neoprene Quality Control Tests**

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Minimum Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Properties</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hardness (Shore A Durometer)</td>
<td><strong>ASTM D 2240</strong></td>
<td>50 ± 5 60 ± 5 70 ± 5</td>
</tr>
<tr>
<td>Tensile Strength, Min. psi</td>
<td><strong>ASTM D 412</strong></td>
<td>2,250 2,250 2,250</td>
</tr>
<tr>
<td>Ultimate Elongation, min. %</td>
<td><strong>ASTM D 573</strong></td>
<td>15 15 15</td>
</tr>
<tr>
<td>Change in Durometer Hardness, max. points</td>
<td><strong>ASTM D 573</strong></td>
<td>15 15 15</td>
</tr>
<tr>
<td>Change in Tensile Strength, max. %</td>
<td><strong>ASTM D 573</strong></td>
<td>15 15 15</td>
</tr>
<tr>
<td>Change in Ultimate Elongation, max. %</td>
<td><strong>ASTM D 573</strong></td>
<td>15 15 15</td>
</tr>
<tr>
<td><strong>Heat Resistance</strong></td>
<td><strong>ASTM D 395</strong> Method B</td>
<td>35 35 35</td>
</tr>
<tr>
<td><strong>Compression Set</strong></td>
<td><strong>ASTM D 395</strong> Method B</td>
<td>35 35 35</td>
</tr>
<tr>
<td>22 h @ 212 F, max. %</td>
<td><strong>ASTM D 395</strong> Method B</td>
<td>35 35 35</td>
</tr>
<tr>
<td><strong>Ozone</strong></td>
<td><strong>ASTM D 1149</strong></td>
<td>No Cracks</td>
</tr>
<tr>
<td>100 ppm Ozone in Air by Volume, 20% Strain 100F ± 2F</td>
<td><strong>ASTM D 518, Procedure A</strong></td>
<td>No Cracks</td>
</tr>
<tr>
<td>100 h Mounting Procedure</td>
<td><strong>ASTM D 1149</strong></td>
<td>No Cracks</td>
</tr>
<tr>
<td><strong>Low Temperature Britteness</strong></td>
<td><strong>ASTM D 746</strong> Procedure B</td>
<td>No Failure</td>
</tr>
<tr>
<td>Grades 0 &amp; 2</td>
<td><strong>ASTM D 746</strong> Procedure B</td>
<td>No Failure</td>
</tr>
<tr>
<td>Grade 3 Tested @ -40F</td>
<td>Grade 4 Tested @ -55F</td>
<td>No Failure</td>
</tr>
<tr>
<td>Grade 5 Tested @ -70F</td>
<td>Grade 4 Tested @ -50F</td>
<td>No Failure</td>
</tr>
<tr>
<td>Grade 5 Tested @ -65F</td>
<td>Grade 4 Tested @ -50F</td>
<td>No Failure</td>
</tr>
<tr>
<td><strong>Instantaneous Thermal Stiffening</strong></td>
<td><strong>ASTM D 1043</strong></td>
<td>Stiffness(1) at test temperature not to exceed 4 times the stiffness measured at 73F.</td>
</tr>
<tr>
<td>Grades 0 &amp; 2 @ -25F</td>
<td>Grade 3 Tested @ -40F</td>
<td>No Failure</td>
</tr>
<tr>
<td>Grade 3 Tested @ -40F</td>
<td>Grade 4 Tested @ -50F</td>
<td>No Failure</td>
</tr>
<tr>
<td>Grade 4 Tested @ -65F</td>
<td>Grade 5 Tested @ -65F</td>
<td>No Failure</td>
</tr>
<tr>
<td><strong>Low Temperature Crystallation</strong></td>
<td><strong>Quad Shear Test as described(2)</strong></td>
<td>Stiffness(1) at test time and temperature not to exceed 4 times the stiffness at 73F with no time delay.</td>
</tr>
<tr>
<td>Grade 0</td>
<td>Grade 2, 7 days @ 0F</td>
<td>No test required</td>
</tr>
<tr>
<td>Grade 3, 14 days @ -15F</td>
<td>Grade 4, 21 days @ -35F</td>
<td>No test required</td>
</tr>
<tr>
<td>Grade 4, 21 days @ -35F</td>
<td>Grade 5, 28 days @ -35F</td>
<td>No test required</td>
</tr>
</tbody>
</table>

(1) Stiffness measured at 73F.

(2) Quad Shear Test as described.
Note in Table A that **ASTM D 1043** refers to —modulus of rigidity—, while **ASTM D 4014**, referenced in the text, refers to —shear modulus stiffness—. The word —stiffness— is used in Table A to cover both terms.

(2) Measure the stiffness with a quad shear rig in an enclosed freezer unit. Take test specimens from a randomly selected bearing. Use a 25% strain cycle and apply a complete cycle of strain with a period of 100 seconds. Discard the first 3/4 cycle of strain and determine the stiffness by the slope of the force deflection curve for the next 1/2 cycle of loading.

2. Frequency of Testing.
   a. Conduct ambient temperature tests as specified below in Section 2.02.E.3 for each lot of bearings. Provide test certificates from the supplier for each lot of reinforcement.
   b. Conduct low temperature tests as specified in Section 2.02.E.4 for each lot of bearings.
   c. Visually inspect every finished bearing as specified in Section 2.02.E.5.
   A. Conduct short-duration compression tests as specified in Section 2.02.E.6 on every steel reinforced
   B. If required, conduct shear stiffness tests on material from a random sample of the finished bearings as specified in Section 2.02.E.8.

   a. Use elastomer conforming to Table A for durometer hardness, tensile strength, ultimate elongation, heat resistance, compression set, and ozone resistance. Ensure that the bond to the reinforcement conforms to the requirements specified in Section 1113.02(d).
   b. Test the shear modulus of the material at 73°F according to Annex A of ASTM D 4014. Ensure that the measured shear modulus is within 15% of the specified value. If no shear modulus is specified, ensure that the hardness falls within the range given in Article 14.7.5.2 of the LRFD Specification. Instead of performing a shear modulus test for each batch of material, the manufacturer may, if permitted, provide certificates from tests performed on identical formulations within the preceding year.

   a. Conduct low temperature brittleness tests (ASTM D 746), instantaneous low temperature stiffness tests (ASTM D 1043), and low temperature crystallization tests (ASTM D 4014) on grades 3, 4, and 5 elastomers. For grade 3 elastomers, instead of conducting low temperature crystallization tests, the manufacturer may provide certificates from low temperature crystallization tests performed on identical material within the last year, unless the tests are required.
   b. Conduct instantaneous low temperature stiffness tests (ASTM D 1043) on grades 0 and 2 elastomers. If required, conduct low temperature brittleness tests (ASTM D 746) and low temperature crystallization tests (ASTM D 4014) on grades 0 and 2 elastomers.
   c. Perform all tests according to Table A and ensure the compound satisfies all limits for its grade.
5. **Visual Inspection of the Finished Bearing**: Inspect every finished bearing for compliance with dimensional tolerances and for overall quality of manufacture. In steel reinforced bearings, protect the edges of the steel everywhere from corrosion.

6. **Short-Duration Compression Tests on Bearings**: Load the bearing in compression to 1.5 times its maximum design load. Hold the load constant for 5 minutes, remove, and reapply for another 5 minutes. Visually examine the bearing while under the second loading. If the bulging pattern suggests laminate parallelism or a layer thickness that is outside the specified tolerances, or poor laminate bond, reject the bearing. If there are three or more separate surface cracks that are greater than 0.08 inch wide and 0.08 inch deep, reject the bearing.

7. **Long-Duration Compression Tests on Bearings**: Load the bearing in compression to 1.5 times its maximum design load for a minimum period of 15 hours. If during the test the load falls below 1.3 times the maximum design load, increase the test duration by the period of time for which the load is below this limit. Visually examine the bearing at the end of the test while it is still under load. If the bulging pattern suggests laminate parallelism or a layer thickness that is outside the specified tolerances, or poor laminate bond, reject the bearing. If there are three or more separate surface cracks that are greater than 0.08 inch wide and 0.08 inch deep, reject the bearing.

8. **Shear Modulus Tests on Material from Bearings**: Cut a specimen from the finished bearing and test the shear modulus of the material according to Annex A of ASTM D 4014, or, if acceptable, conduct a comparable nondestructive stiffness test on a pair of finished bearings. Ensure that the measured shear modulus is within 15% of the specified value. If no shear modulus is specified, ensure that the hardness falls within the range given in Article 14.7.5.2 of the LRFD Specification. If the test is conducted on finished bearings, compute the material shear modulus from the measured shear stiffness of the bearings, taking due account of the influence on shear stiffness of bearing geometry and compressive load.

F. **Tolerances**: Provide finished pads within the following tolerances:

- **Overall Height**
  - Design Thickness 1 1/4 inches or less: +1/8 inch
  - Design Thickness over 1 1/4 inches: +1/4 inch
- **Overall Horizontal Dimensions**
  - 3 feet or less: +1/4 inch
  - Over 3 feet: +1/2 inch
- **Thickness of Individual Layers of Elastomer**
  (Laminated Bearings Only)
  - At any point within the bearings: ±20% of design value but no more than ±1/8 inch
- **Parallelism with Opposite Face**
  - Top and bottom: 0.005 rad
  - Sides: 0.02 rad
- **Position of Exposed Connection Members Hole, slots or inserts**: ±1/8 inch
- **Edge Cover**
  - Embedded laminates or connection members: +1/8 inch
- **Thickness**
  - Top and bottom cover layer (if required): -0, the smaller of 1/16 inch and +20% of the nominal cover layer thickness
G. Bedding Material for Bridge Shoes. Manufacture material from elastomeric material reinforced with organic fiber as filler material. The fiber may be oriented or random (Type I), or in the form of fabric (single or multiple laminations, Type II). Certify as specified in Section 106.03(b)3. Furnish finished pads conforming to the following requirements:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Type I</th>
<th>Type II</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tensile Strength.</strong> ASTM D 378, Die A, min.</td>
<td>500 psi</td>
<td>1,500 psi</td>
</tr>
<tr>
<td><strong>Oven Aging.</strong> 7 days at 158F, change in actual tensile strength not to exceed</td>
<td>±40%</td>
<td>±40%</td>
</tr>
<tr>
<td><strong>Compressibility.</strong> ASTM F 36, Procedure H., without high temperature preconditioning</td>
<td>min. 10%</td>
<td>max 20%</td>
</tr>
<tr>
<td><strong>Compressive Strength.</strong> 4-inch by 4-inch specimen, compressed to rupture between flat plates</td>
<td>min. 5,000 psi</td>
<td>max 8,000 psi</td>
</tr>
<tr>
<td><strong>Water Absorption.</strong> 24-hour immersion</td>
<td>max. 3.5%</td>
<td>0%</td>
</tr>
</tbody>
</table>

- Size
  Holes, slots, or inserts ±1/8 inch
PART 3– EXECUTION

This section not used.

END OF SECTION 05610
SECTION 05620
BRONZE INSCRIPTION TABLET

PART 1 – GENERAL

1.01 DESCRIPTION
A. This work is the furnishing and placement of two (2) bronze alloy Inscription Tablets as shown in the construction plans.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 - General Requirements

1.03 SUBMITTALS
A. Submit the following to the Engineer for approval. Do not CAST the Tablet until approval of the following is received:
   1. The preliminary and final rubbings (or a drawing or photographic copy) of the Tablet, showing pattern, letter and style layout.
   2. Samples of the tablet material showing the color, texture and finish of the surface of the letters, border sculpture and background.
   3. Provide a Tablet with lines centered and incorporating raised Roman style numbers and CAPITAL letters, all as detailed on the contract Drawings.
   4. Use numbers and letters, proportional in widths and heights.
   5. Names to be incorporated on the Tablet are to be current at the time of Notice to Proceed.
   6. Names/Titles on the plaque will be finalized through Contractor’s construction submission.
   7. A Tablet Cast before approval of the above material is received, may be rejected by the Engineer. Rejected Tablets become the property of the contractor.

PART 2– PRODUCTS

2.01 MATERIAL
A. Furnish and place a bronze alloy Inscription Tablet containing 90% copper, 8% zinc and 2% tin, true to pattern as to form and dimensions, free from casting faults, sponginess, blow holes, porosity, hard spots, shrinkage cracks or other defects, and smooth and well cleaned of scale and mold debris.

PART 3– EXECUTION
This section not used.
END OF SECTION 05620
SECTION 07130
WATERPROOFING MEMBRANE

PART 1 – GENERAL

1.01 DESCRIPTION
   A. This work is the furnishing and placing of adhesive preformed membrane waterproofing systems to concrete or other surfaces as indicated.

1.02 RELATED SECTIONS
   A. Contract Agreement
   B. Division 1 - General Requirements
   C. Section 03300 - Cast-in-Place Concrete

1.03 SUBMITTALS
   A. Submit the following in accordance with Section 01300:
      1. Product Data: Material specifications, substrate preparation procedures, installation instructions, use limitations and general recommendations from the various waterproofing manufacturers for the types of products required.
      2. Shop Drawings: Show locations and extent of waterproofing. Include details for substrate joints and cracks, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions. Shop drawings shall also show installation plan and details for the protection board.

1.04 QUALITY ASSURANCE
   A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
      1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
         b. PennDOT Publication 408, Specifications
         c. PennDOT Publication 218M, Bridge Design (Standard Drawings)
         d. PennDOT Publication 219M, Bridge Construction (Standard Drawings)
   B. Manufacturer Qualifications: Unless specified or shown on the plans, select from the waterproofing systems listed in Bulletin15.
   C. Manufacturer Technical Representative: Ensure that a trained Manufacturer’s Technical Representative is present during every phase of application, unless applied by a factory trained licensed installer, as indicated by written approval from the material supplier. The Manufacturer’s Technical Representative will provide training and technical assistance on surface preparation, equipment, mixing of components, type, and method of application, and finish.

1.05 DELIVERY, STORAGE AND HANDLING
   A. Comply with provisions of Section 01600.
   B. Assume sole responsibility for properly receiving, handling and storing all materials furnished under this Section from the time that such materials are delivered to the site until final acceptance of the work by SEPTA.
C. Deliver materials in manufacturer’s original unopened packaging with all labels intact. Maintain packaged materials in original containers with labels intact and with seals unbroken until time of use. All contained material shall have readable labels for the duration of the work.

D. Store and handle in strict compliance with manufacturer’s instructions, recommendations, and material safety data sheets. Protect from damage from direct sunlight, weather, excessive temperatures and construction operations. Store materials above ground in a dry place. Remove damaged materials from site and dispose of in accordance with applicable regulations.

E. Certification: Certify each shipment as specified in PennDOT Publication 408, Specifications, Section 106.03(b)3. Visibly label all shipments on the membranes or containers with the manufacturer’s name, membrane trade name, lot number, and material quantity.

PART 2– PRODUCTS

2.01 MATERIALS

A. Adhesives, Conditioners, Primers, Mastics, Two-Part Liquid Urethane Membranes and Sealing Tapes: As recommended for use with the respective preformed membrane sheet materials. Contact the membrane manufacturer or its representative for instructions.

B. Adhesive-Backed Preformed Membrane Sheet: Furnish Adhesive-Backed Preformed Membrane Sheet consisting of a sheet of rubberized asphalt or polymer modified bitumen permanently applied to a polyethylene film, or reinforced with a stitch-bonded polyester/polypropylene fabric, or reinforced with a fiberglass mesh and conforming to the minimum requirements specified in Table A.

C. Protective Covers: Provide a 1/8-inch thick, asphalt protective board or 65-pound roofing material without mica coating, or approved equal that furnishes equivalent protection to the membrane from being cut, scratched, or otherwise damaged from the backfill or equipment.

D. Bonding Material: PennDOT Publication 408, Specifications, Section 460 and as recommended by the manufacturer.
### TABLE A (English)
Adhesive-Backed Preformed Membrane Sheet Minimum Requirements

<table>
<thead>
<tr>
<th>Property</th>
<th>Test</th>
<th>For Bridge Deck Surfaces</th>
<th>For Surfaces Other Than Bridge Decks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rubberized Asphalt Type</td>
<td>Modified Bitumen Type</td>
</tr>
<tr>
<td>Tensile Strength, lbs/in (minimum)</td>
<td>ASTM D 882</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>% Elongation at Break, (min)</td>
<td>ASTM D 882</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Pliability</td>
<td>ASTM D 146</td>
<td>No cracks</td>
<td>No cracks</td>
</tr>
<tr>
<td>Thickness, mils (minimum)</td>
<td>ASTM D 1000</td>
<td>Polyethylene Film</td>
<td>Fabric Reinforced Backed—60 FRM Backed—65</td>
</tr>
<tr>
<td>Softening Point, F (minimum)</td>
<td>ASTM D 36</td>
<td>190</td>
<td>210</td>
</tr>
<tr>
<td>Permeance, perms (maximum)</td>
<td>ASTM E 96,</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Puncture Resistance, lbs. (min)</td>
<td>ASTM E 154</td>
<td>25</td>
<td>25</td>
</tr>
</tbody>
</table>

**Notes:**
1. Breaking factor in machine direction.
2. Method A. 1-inch wide strip with 4-inch minimum initial separation and 4-inch gage length at 2 inches per minute. Average 5 samples.
3. At 73.4°F ± 3.6°F.
5. 180-degree bend over a 1-inch mandrel at -15°F.
6. Total thickness of preformed membrane sheet and polyethylene film or fabric reinforcement.
PART 3– EXECUTION

3.01 CONSTRUCTION

A. Limitation of Operations

1. Apply waterproofing only if protective covering can also be placed within a time that ensures that the membrane will not be damaged by personnel, equipment, exposure to weathering, or from any other cause.

2. Do not install any part of a waterproofing system in wet, humid, or foggy weather conditions, or if the ambient or concrete surface temperature is below 50F, unless recommended by the manufacturer and authorized in writing by the Project Manager. Apply the primer and waterproofing membrane only when the concrete surfaces are completely dry.

B. Surface Preparation

1. Prepare the surface to be waterproofed to a condition free from holes or projections that might puncture or otherwise damage the membrane. Round (outside) or chamfer (inside) all sharp corners to be covered.

2. Thoroughly clean all concrete surfaces that are to be waterproofed. Remove any excess laitance, oil, concrete curing compounds, previous membrane treatments, and other foreign materials by sandblasting. Remove all dirt, dust, loose or unsound concrete, and other extraneous material by vacuuming or blowing with compressed air.

C. Applying Conditioners and Primers

1. Thoroughly mix and continuously agitate all primers and conditioners during application according to the manufacturer’s instructions. Uniformly apply primer or conditioner to the entire area to be sealed, at the rate stated in the manufacturer’s instructions, by squeegee, brush, or roller. Do not apply the primer by spraying. Apply a second coat of primer to any areas of concrete that appear dry. Brush out primer that tends to puddle in low spots to allow complete drying. Cure the primer according to the manufacturer’s instructions. Do not let primed areas stand uncovered overnight.

2. After the primer has dried to a tack free condition, use squeegees or brooms to break any bubbles in the primer. Unless otherwise directed, do not repair the areas where bubbles were broken. If membrane sheets are not placed over primer or conditioner within the time recommended by the manufacturer, recoat the surfaces at no additional cost to SEPTA.

3. Before applying the primer or conditioner on a bridge deck, place an oil resistant protective film, held with an adhesive or tape, to any deck areas that will later be covered by expansion dams or headers. Place membrane seal and asphalt concrete across the protective film. If directed, cut the protective film and the preformed sheet at or near the expansion joint.

D. Adhesive-Backed Preformed Membrane Waterproofing Systems

1. Install as shown on the PennDOT Standard Drawings, and as specified in PennDOT Publication 408, Specifications, Section 680.3(b) and as follows:

   a. On vertical surfaces, place preformed membrane material with each successive horizontal sheet lapped top over bottom to the preceding by a minimum of 3 inches. Lap horizontal splices by a minimum of 6 inches. Seal the exposed edges of membrane sheets after the membrane is placed
with a troweled bead of a manufacturer's recommended mastic, or two-part
urethane liquid membrane, or with sealing tape.

b. Provide watertight construction by flashing all projecting pipes, conduits,
sleeves, or other facilities passing through the preformed membrane
waterproofing with prefabricated or field fabricated boots, fitted coverings,
or other approved devices as necessary.

c. Install protective covers after the application of waterproofing membrane.
Apply bonding material, of a type recommended by the waterproofing
manufacturer to the surface of the membrane and adjacent concrete
surface at a rate, approximately 0.05 gallon per square yard, sufficient to
hold the protective covering in position until the backfill is placed. Allow the
bonding material to dry until tacky. Place the sheets of protective board or
roofing material on the bonding material with edges or ends of the boards
either loosely butt-jointed or overlapped.

E. Nonstandard Applications: For areas not covered in this specification regarding special
application techniques of the waterproofing materials, or regarding special application
restrictions, follow the manufacturer's recommendations.

F. Defective Work: Before placing backfill, structural backfill, subbase, or bituminous
material, repair or replace damaged membranes or protective coverings according to the
manufacturer's recommendations at no additional expense to SEPTA.

END OF SECTION 07130
PART 1 – GENERAL

1.01 DESCRIPTION
A. The work specified in this Section consists of all labor, materials, equipment and services necessary to perform surface preparation and provide shop painting and finishing of all shop-coated surfaces of new structural steel, new aluminum barrier, new concrete barrier pylasters and recessed formlined concrete barrier surfaces, and to perform surface preparation and field finishing of specified concrete surfaces, see 3.04, with a penetrating sealer/anti-graffiti coating.

B. This work shall include the proper cleaning and preparation of the surfaces to be painted; the furnishing, application, protection and curing of the coatings; the furnishing of all tools, tackle, scaffolding, testing equipment, labor and materials necessary for the entire work; and the pollution controls for painting and surface preparation in compliance with the Federal, State and local regulations.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 - General Requirements
C. Section 02085 – Treatment and Handling of Materials with Lead-Based Paint
D. Section 03300 - Cast-in-Place Concrete
E. Section 04900 - Masonry Restoration and Cleaning
F. Section 05120 - Structural Steel
G. Section 055820 – Aluminum Protective Barrier

1.03 SUBMITTALS
A. Submit the following in accordance with Section 01300:
1. Submit approvals from specified agencies for the Contractor's proposed containment methods, test results of paint waste materials, and all associated documentation regarding disposal of paint cleaning waste.

2. Samples: Submit sample color chips of standard colors and samples of any required intermixes for the Project Manager's review and selection of color and texture.

3. Submit manufacturer's specifications, including paint label analysis, recommended repair procedures, and application instructions for each system specified. If an alternate manufacturer is proposed, submit complete evidence of comparable quality and performance.

4. Schedule and Product Data: Submit paint schedule indicating which of the selected manufacturer's products are intended for use. Do not perform painting work without the Project Manager's approval of submitted paint schedule.

B. No substitutions of materials or methods will be permitted without approval, in writing by the Project Manager.
1.04 QUALITY ASSURANCE

A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.

1. Commonwealth of Pennsylvania, Department of Transportation (PennDOT):
   a. PennDOT Publication 408, Specifications
   b. PennDOT Publication 35, Bulletin 15, Approved Construction Materials
2. Steel Structures Painting Council (SSPC) Painting Manual.
3. Occupational Safety and Health Administration (OSHA) Standards.
5. Military Specification MIL-C-16173D

B. Applicator Qualifications: Painting applicator shall be certified by SSPC and show evidence of acceptability as a qualified applicator by the manufacturer of products specified herein. Submit such evidence with Submittals as specified herein.

C. Technical Representation: Furnish the services of a paint or a painting technical representative from the paint manufacturer at the beginning of operations and whenever required during painting operations.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials to the project site in original, new and unopened packages and containers bearing manufacturer's name and label.

B. Provide labels on each container with the following information:

1. Name or title of material.
3. Manufacturer's stock number.
4. Manufacturer's name.
5. Contents by volume, for major pigment and vehicle constituents.
6. Thinning instructions.
7. Application instructions.

1.06 PROJECT CONDITIONS

A. Field and Shop Coat Compatibility: To insure satisfactory paint and coating performance, it is a Contract requirement that products applied in the shop and field be mutually compatible from the same manufacturer.

1. The Contractor shall require fabricators to apply shop coats that are compatible with field coats specified herein.

B. Environmental Requirements:

1. Adhere to manufacturer’s data on air and surface temperature limits and relative humidity during application and curing of coatings.
2. Do not spray apply paint when wind velocity is above 7 meters per second.
3. Schedule coating work to avoid dust and airborne contaminants.
4. Apply exterior finishes during daylight hours only.
5. When painting must be done in confined spaces, or because of unfavorable ambient conditions, longer drying times will be necessary.
C. Protection:
1. Protect painting materials before, during and after applications, and protect other work and materials with drop cloths or other impervious material as specified in Article 3.01 herein.

PART 2 – PRODUCTS

2.01 STRUCTURAL STEEL COATING SYSTEMS
A. It is the intent of these Specifications that the Contractor provide coating products of one manufacturer.
B. Select Coating System for Bridge Superstructure Steel from Bulletin 15, Approved Construction Materials.
   1. Primer paint shall be certified to be Class A or B in accordance with the test method adopted by the Research Council on structural connections as given in the “Specification for Structural Joints Using ASTM A325 or A490 Bolts”.
C. Paint color for structural steel coating systems to match as closely as possible to Federal Color Number 20122 (Dark Brown) using Federal Standard 595C.

2.02 ALUMINUM COATING SYSTEM
A. Paint color for aluminum barrier coating systems to match as closely as possible to Federal Color Number #36373 using Federal Standard 595C.

2.03 PENETRATING SEALER/ANTI-GRAFFITI COATING
A. Provide a water-based, breathable, gloss-free, non-yellowing, non-sacrificial, penetrating sealer/anti-graffiti coating on specified surfaces, see 3.04. Sealer shall be a specifically formulated siloxane resin that provides an effective water-repellent, chloride-ion repellent and graffiti-resistant seal for absorbent cementitious surfaces. The sealer shall not create a vapor barrier.
B. Sealer color to match as closely as possible to Federal Colors using Federal Standard 595C as follows:
   1. Concrete Pilaster, Federal Color Number #36373.
   2. Recessed Concrete Formliner, Federal Color Number #36373.
   3. Primary Concrete Barrier, Federal Color Number #36373.
C. Acceptable Products/Manufacturers:
   1. Siloseal WB; L&M Construction Chemicals, Omaha, NE.
   2. Pro Industrial Anti-Graffiti Coating; Sherwin Williams, Malvern, PA.
   4. Or approved equal.

2.04 RUST CONVERTER
A. Provide a water-based, weather-proof coating treatment that chemically neutralizes corrosion on steel and iron surfaces and converts the rust by-product into a hard black polymer surface that offers effective protection against formation of new corrosion. Apply as needed to remove corrosion from corroded painted or unpainted steel surfaces
that are inaccessible to conventional methods of corrosion removal and protective coating. Apply product in accordance with manufacturer’s written instructions.

B. Acceptable Products/Manufacturers:
   1. Stop Rust; Cantol Corporation, Sharon Hill, PA.
   2. High Performance V2100 System Rust Reformer Spray, Rust-Oleum Corporation, Vernon Hills, IL.

PART 3 – EXECUTION

3.01 GENERAL
   A. Conform to PennDOT Publication 408, Specifications, Section 1060.3(a), "Painting Structural Steel, Construction, General," and Steel Structures Painting Council, Paint Applications Specifications, No. 1 (PA-1), and as otherwise specified herein.

3.02 INSPECTION
   A. Examine the areas and conditions under which painting work is to be applied. Remedy any conditions detrimental to the proper and timely completion of the work. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
   B. Starting of painting work will be construed as the Applicator's acceptance of the surfaces and conditions within any particular area.
   C. Do not paint over dirt, rust, scale, grease, moisture, or conditions otherwise detrimental to the formation of a durable paint film.
   D. Coordination of Work
      1. Review other Sections in which primers are provided to ensure compatibility of total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
      2. Notify Owner about anticipated problems using materials specified over substrates primed by others.

3.03 SURFACES TO BE PAINTED
   A. Paint all superstructure (weathering) steel within a distance of 1 1/2 times the depth of girder from bridge joints not to be less than five (5) feet.
   B. Paint all utility supports and sole plates.
   C. Do not apply the Aluminum-Filled Mastic primer to steel surfaces that will be in contact with concrete. Paint areas in contact with concrete with an approved inorganic zinc-rich primer.
   D. Paint aluminum protective barrier.

3.04 SURFACES TO BE COATED WITH PENETRATING SEALER/ANTI-GRAFFITI COATING
   A. All exposed portions and 3-feet below grade of the abutments and wingwalls shall be treated with penetrating sealer/anti-graffiti coating.
   B. Apply to top, outside face and inside face of concrete barriers and pilaster.
   C. Apply to outside edge of deck and underside of deck overhangs.
   D. Apply to front face of end diaphragms.
3.05 **PAINT MATERIALS PREPARATION**

A. Store materials, not in actual use, in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

B. Stir materials before application to produce a mixture of uniform density, and stir as required during the application of the materials. Do not stir surface film into the material, remove the film and if necessary, strain the material before using.

C. Clean and prepare surfaces to be painted according to OSHA requirements.

3.06 **SURFACE PREPARATION**

A. Solvent Cleaning: Where oil and grease are present remove in accordance with the SSPC Surface Preparation Specification using No. 1 Solvent Cleaning (SSPC-SP1). Perform cleaning prior to blasting. If contamination remains after blasting, reclean with solvent.

B. Other Cleaning: Remove soil, concrete spatter, drawing compounds, salts, or other foreign matter by brushing with stiff fiber or wire brushes; by scraping; by cleaning with solutions of bio-degradable cleaners, provided such cleaners are followed by a fresh water rinse or by a combination of these methods. Satisfactorily remove detrimental deposits from new weld areas. When directed, remove water soluble salts, by high pressure water blast cleaning.

C. Blast Cleaning New Structural Steel: Blast clean all new structural steel to a near-white condition, as defined in SSPC SP-10/NACE No. 2. Determine the near white condition by use of SSPC -VIS 1-89. Blast clean to leave an anchor pattern, from 40 to 90 microns deep, in a dense, uniform pattern of depressions and ridges. Determine pattern depth as measured by a Keane-Tator Surface Profile Comparator or Testex Replica Tape. Grind laminations raised by the blasting operation to a flush surface and reblast the ground area to obtain the specified anchor pattern.

D. Cleaning Concrete: Prepare concrete surfaces to be coated with the penetrating sealer/anti-graffiti coating as recommended by the sealer manufacturer.

3.07 **WORKER PROTECTION**

A. Conform to requirements specified in Section 02085.

3.08 **HAZARDOUS WASTE HANDLING AND DISPOSAL PROCEDURES**

A. Conform to requirements specified in Section 02085.

3.09 **APPLICATION**

A. Metal Surfaces:

1. Mixing and thinning paint: As recommended by the paint manufacture.

2. Conditions for painting:

   a. Apply paint only on clean and dry surfaces and only during periods of favorable weather. Do not paint when the temperature of the air, paint, or metal is below 4.5°C, and at no time below that described in the technical data sheet; when the air is misty; or when conditions are otherwise unsatisfactory. Do not paint damp or frosted surfaces or surfaces hot enough to cause the paint to blister, to produce a porous paint film, or to cause the vehicle to separate from the pigment. Paint only when the surface temperature is at least 2.8°C above the dewpoint. Determine the dewpoint with the use of a psychrometer and psychometric tables.
b. Allow each coat of paint to dry before applying the succeeding coat. Follow the manufacturer’s recommendations for drying time, unless a longer drying time is required.

c. In damp or cold weather, keep the shop work under cover until thoroughly dry, or until weather conditions permit exposure.

3. Application:

a. Apply paint to steel surfaces in accordance with SSPC-PA-1 and as described herein.

b. Apply primer and subsequent coats immediately after inspection and acceptance of the surface. Apply primer the same day the metal is cleaned. If metal is blast cleaned and remains overnight, blast clean again prior to priming.

c. Apply primers in accordance with the manufacturer’s recommendations. Stripping of the inorganic zinc-rich primer is not required.

d. For application of the intermediate and finish coats wet stripe all edges, bolts, rivets, welds, corners, crevices and other irregularities either by brush or by a separate and distinct spray operation prior to the application of the full coat.

e. Apply intermediate and final coats to areas of steel that will be inaccessible prior to the stage of construction that prevents access.

4. Thickness of Coats:

a. Primer: Apply, as recommended by the manufacturer, in a single application, to a minimum dry film thickness of 100 to 200 microns above the cleaned base metal. A dense and uniform appearance is required after the applied coating has cured. Use a color that contrasts with the color of the cleaned base metal.

b. Intermediate Coat: Apply as recommended by the manufacturer, in a single application, to a minimum dry film thickness of 75 to 150 microns. A dense and uniform appearance is required after the applied coating has cured.

c. Finish Coat: Apply, as recommended by the manufacturer, in a single application, to a minimum dry film thickness of 75 to 150 microns. Provide a finish that is uniform in color and appearance.

5. Succeeding coats shall show visual difference from preceding coats.

6. Inspection and Testing: Perform dry film thickness tests on each coat of all metal coating systems, shop and field applied. Perform tests for field applied coatings in the presence of the Project Manager. Testing shall comply with the requirements specified in SSPC-PA 2, “Measurement for Dry Paint Thickness with Magnetic Gages.” Test results including gage type used shall be reported in writing to the Project Manager.

B. Penetrating Sealer/Anti-graffiti Coating Application:

1. Follow manufacturer’s instructions for spray-on application of concrete sealer, especially with regard to proper surface preparation and environmental conditions.

2. Remove grease, curing compounds, surface treatments and other bond-inhibiting materials from surfaces to receive the concrete sealer. Verify that concrete is in sound condition before applying sealer.

3. Apply spray-on sealer with hand-pressure equipment rather than compressed-air drive equipment.
3.10 FIELD TOUCH-UP

A. Painting:
   1. General: Paint field bolted connections, field welds and areas within 50 mm of welds and touch up abrasions in the shop coats.
   2. Surface preparation: Use methods at least as effective as those specified for the structure itself but in no case less than SSPC-SP-3 for removal of handling marks and for areas showing rust.
   3. Paint: Use those individual products as specified herein.

3.11 FINAL INSPECTION AND CORRECTIVE WORK

A. As specified in Section 01700, Contract Closeout, except make an additional inspection accompanied by the Project Manager one year after date of acceptance of this project.

B. Removal of Unsatisfactory Paint: The painting is unsatisfactory if rusting occurs; the paint coat lifts, blisters, wrinkles, has excessive runs or sags, or shows evidence of application under unfavorable conditions; the workmanship is poor; impure or unauthorized paint has been used; or for other reasons determined by the Project Manager. Remove unsatisfactory paint, clean the metal, and repaint, as specified.

3.12 CLEAN-UP AND PROTECTION

A. Clean-up: During the progress of the work, remove from the project daily all discarded paint materials, rubbish, cans and rags.
   1. Upon completion of painting work, clean all paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

B. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing and repainting, as directed.

END OF SECTION 09900
SECTION 10020
MAINTENANCE AND PROTECTION OF TRAFFIC DURING CONSTRUCTION

PART 1– GENERAL

1.01 DESCRIPTION
A. This work is the furnishing, installing, maintaining, and relocating of traffic control devices. This work may include flagging and pilot car operation for guidance of traffic through the temporary traffic control zone and dust control. All work shall be done as specified in these Specifications, the PennDOT Publication 212, PennDOT Publication 213, and the MUTCD, PennDOT Standard Drawings, the approved Traffic Control Plans (TCP), and as directed.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 10040 – Hot Thermoplastic Pavement Markings
D. Section 10060 – Preformed Thermoplastic Pavement markings
E. Section 10070 – Pavement Marking Removal

1.03 SUBMITTALS
A. Contractor must submit plans for review and approval for any proposed changes to the 100% Design Traffic Control plans.
B. Contractor must submit catalog cuts of all proposed materials showing they are in accordance with the 100% Design Plans, Construction Specifications and Special Provisions.

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications
      b. PennDOT Publication 212, Official Traffic Control Devices
      c. PennDOT Publication 213, Temporary Traffic Control Guidelines
   2. U.S. Department of Transportation, Federal Highway Administration:

PART 2– PRODUCTS

2.01 MATERIALS
A. Furnish material and traffic control devices necessary for maintenance and protection of traffic, and conforming to the TCP, Publication 212, Publication 213, and the MUTCD, and as follows:
   1. Temporary Barrier – PennDOT Publication 408, Specifications, Section 627.2
2. Temporary Concrete Barrier, Structure Mounted – PennDOT Publication 408, Specifications, Section 643.2
3. Temporary Concrete Median Barrier, Structure Mounted – PennDOT Publication 408, Specifications, Section 643.2
4. Temporary Concrete Glare Screen Median Barrier, Structure Mounted – PennDOT Publication 408, Specifications, Section 643.2
5. Temporary Impact Attenuating Devices – PennDOT Publication 408, Specifications, Section 696.2
6. Reset Temporary Barrier – PennDOT Publication 408, Specifications, Section 628.2
7. Temporary Concrete Barrier, Structure Mounted, Reset – PennDOT Publication 408, Specifications, Section 644.2
8. Temporary Concrete Median Barrier, Structure Mounted, Reset – PennDOT Publication 408, Specifications, Section 644.2
9. Temporary Concrete Glare Screen Median Barrier, Structure Mounted, Reset – PennDOT Publication 408, Specifications, Section 644.2
10. Reset Temporary Impact Attenuating Devices – PennDOT Publication 408, Specifications, Section 697.2
11. Painting Traffic Lines and Markings – PennDOT Publication 408, Specifications, Section 962.2
12. Bituminous Tack Coat – PennDOT Publication 408, Specifications, Section 460.2
13. Bituminous Wearing Course FJ-1 – PennDOT Publication 408, Specifications, Section 422.2
14. Shadow Vehicle – A truck equipped with a flashing or revolving yellow light and as specified in PennDOT Publication 212, PennDOT Publication 213, and the MUTCD.
15. Truck Mounted Impact Attenuator and/or Arrow Panel – Installed on the shadow vehicle, as required in PennDOT Publication 212, PennDOT Publication 213, and the MUTCD.
16. Adhesive – PennDOT Publication 408, Specifications, Section 966.2(c)
17. Temporary Traffic Control Signals – PennDOT Publication 408, Specifications, Section 1124
18. Temporary Traffic Control Signals, Reset – PennDOT Publication 408, Specifications, Section 1124
19. Temporary Trolley Detour Signs – To be provided by SEPTA, see Sample of Sign at end of Specification.

B. When traffic line paint and glass beads or pavement marking tape are provided according to the requirements in PennDOT Publication 408, Specifications, Section 1103.14, furnish certification, as specified in PennDOT Publication 408, Specifications, Section 106.03(b)3, that these materials meet specifications.

C. All temporary traffic control devices must be listed in PennDOT Bulletin 15 as NCHRP-350 compliant. Temporary Type III barricades must comply with Standard Drawing TC-8716 or be listed in PennDOT Bulletin 15 as NCHRP-350 compliant.

D. Certification Form CS-4171 is not required for temporary traffic control devices. However, temporary traffic control devices permanently incorporated as part of the project require Form CS-4171, unless otherwise specified in the contract for that particular item.

PART 3 – EXECUTION

3.01 GENERAL

A. Comply with PennDOT Publication 212, PennDOT Publication 213, and the MUTCD.
B. Install and maintain traffic control devices as indicated on the TCP, or an approved alternate plan submitted at the preconstruction conference. The Project Manager may revise the TCP in writing during construction. If unforeseen conditions arise or if revisions are made to the TCP by the Project Manager, install and maintain additional warning lights and traffic control signs on necessary mounting devices according to PennDOT Publication 212, PennDOT Publication 213, and the MUTCD, and at locations designated in writing by the Project Manager. Use PennDOT approved channelizing devices only. Reflectorize channelizing devices according to Publication 212, Publication 213, and the MUTCD. Provide safety for general public and work crew, and protection of work. Schedule construction operations to allow movement of traffic through various phases of construction with minimum interference. If traffic interruptions become too frequent, cease operations in the area concerned, as directed. Take remedial action to correct situation before continuing operations. Remove or cover existing traffic control devices that conflict with the TCP. When conflict no longer exists, erect or uncover them.

C. Install and maintain reduced regulatory speed limit signs in work areas, as indicated on the TCP, approved alternate plan, or as directed.

D. Temporarily remove or cover reduced regulatory speed limit signs when workers are not present, except as otherwise indicated on the TCP, approved alternate plan, or as directed.

E. Install temporary bituminous rumble strips according to locations, patterns, and configurations indicated.

F. Maintain rumble strips in place for the period indicated or as directed, and remove them immediately thereafter. Restore the surface after removal and obtain acceptance.

G. Open any substantially completed section of roadway for the use and convenience of traffic, as directed, and as specified in PennDOT Publication 408, Specifications, Section 107.15. When work is completed, immediately remove temporary traffic control devices.

H. Maintain, clean, and properly operate the devices during the entire time they are in use. Traffic control devices must meet the acceptable or marginal standards of the Pennsylvania Quality Guidelines for Temporary Traffic Control Devices. Remove all devices when no longer required. Where operations are performed in stages, keep only the necessary devices that apply to the present stage of construction in operation.

I. Cover or remove from service signs that do not apply to the existing conditions. Cover with rubber roofing material (EPDM) having a thickness of 0.045 inch or any other approved material, to cover the entire sign. Stabilize and fasten this material to the sign with either plastic or wood to prevent any movement. Do not apply tape to face of sign. Do not deface or damage the sign face using this procedure.

J. Do not allow weeds, brush, trees, construction equipment, materials, and the like to obscure any traffic control device.

3.02 MAINTENANCE OF ROADWAY AND/OR STRUCTURES

A. Treat existing earth roads or improved roads that have been graded, with calcium chloride or by other approved dust control palliatives, as specified in the proposal or as directed.

B. SEPTA reserves the right to enter upon a project and, at its own expense, maintain the existing roadway and/or structures. This maintenance will be during the life of the project, but will not include those items that are the contractor's responsibility as specified in PennDOT Publication 408, Specifications, Section 105.13 for the contract items of work and Part 3.05 of this Section for the accommodation of local traffic. SEPTA does not assume responsibility in any way for maintenance of traffic as a consequence of performing this roadway and/or structure maintenance.
C. If SEPTA does not exercise its right to enter upon a project, then the Contractor is to perform routine maintenance of the existing roadway and/or structures that are open to traffic at no additional cost to SEPTA.

3.03 SNOW REMOVAL AND ANTI-SKID MATERIAL
A. SEPTA reserves the right to enter upon a project and, at its own expense, remove snow and/or place anti-skid material, considered necessary for traffic protection. SEPTA does not assume responsibility in any way for maintenance of traffic as a consequence of removing snow or placing anti-skid material.
B. Remove the anti-skid material when necessary.

3.04 DETOURS AND DIVERSIONS
A. For indicated vehicular and pedestrian detours and trolley diversions, furnish, erect, maintain, and remove the detour signs, unless otherwise directed. Also, temporarily cover, revise, or remove existing permanent guide signs, in the vicinity of the construction site and along the detour route, if the messages on the guide signs conflict with the detour signs. Erect, maintain, and remove the detour signs and the modification of directional signs, as indicated, and as necessary for construction conditions. Restore original signs to their original state upon removal of the detour. SEPTA will provide the trolley diversion sign detail/catalog cuts upon request of the Contractor.

3.05 LOCAL TRAFFIC MAINTENANCE AND SAFETY
A. Proceed with the work to ensure safety and the least inconvenience to local traffic. Maintain local traffic ingress and egress by use of existing or new roadways.
B. Provide and maintain local access to and from the nearest intersecting public road or street, unless otherwise directed. As directed, provide temporary approaches for local vehicular and pedestrian access to and from commuter service, residential, business, industrial, and other public and private facilities.
C. Also, provide and maintain adequate bridging over base and surface courses, trenches, or other construction, when directed.

3.06 EQUIPMENT AND MATERIAL STORAGE
A. According to PennDOT Publication 213.

3.07 TUBULAR MARKERS
A. When indicated, furnish and install tubular markers according to Standard Drawing TC-8604 and the MUTCD.
B. When directed, replace the complete tubular marker or the tubular marker post only, as the case may be.
C. Remove all tubular markers when no longer necessary for traffic control or as directed.

3.08 EXISTING DEPARTMENT SIGNS
A. Remove existing warning, regulatory, guide, and directional signs as required to accommodate construction operations. Do not remove Stop or Yield signs unless an alternate type of traffic control is provided, such as flaggers, temporary traffic signals, etc. Continue the alternate traffic control until the Stop or Yield signs are replaced. Stake or mark sign locations or locate signs on construction drawings before removing any signs. Reinstall existing warning signs at appropriate locations within 4 hours of their removal. With the exception of Stop or Yield signs as herein noted, reinstall existing
regulatory, guide and directional signs at appropriate locations within 24 hours of their removal.

B. Remove existing State Route and Segment markers that are likely to be damaged or disturbed as a result of construction operations. Provide survey ties for all such markers, before the removal, to facilitate replacement.

C. Replace all State Route and Segment markers that were removed, at their exact longitudinal locations, upon completion of the work.

3.09 SURVEILLANCE AND REVIEW OF TRAFFIC CONTROL
A. Designate personnel to be responsible for and to be on-call continuously over traffic control operations. This designee shall always be available to respond to calls involving damage to temporary traffic control devices from causes such as vandalism, traffic accident, or weather. Provide to the Project Manager during the preconstruction conference the name and phone number of the designee providing the surveillance.

B. The Project Manager and the Contractor’s designee shall conduct periodic reviews of the traffic control devices throughout the duration of the project to ensure continuous compliance with the approved TCP. Conduct reviews during the day and night, adverse weather conditions, and active and inactive construction operations, as directed.

3.10 TEMPORARY BARRIER
A. Blunt ends of temporary barrier or glare screen will not be allowed. Protect blunt ends by burying them in a cut slope or using an appropriate end treatment according to the pertinent parts of the following: Design Manual, Part 2, Section 696, and the Standard Drawings.

B. Provide, install, and maintain top-mounted and side-mounted delineators on temporary barriers, glare screen and bridge barrier as indicated on the TCP.

C. Clean or replace all delineators once per month or as directed. Clean in an approved method.

3.11 REMOVAL OF CONFLICTING TRAFFIC LINES AND MARKINGS
A. Remove conflicting pavement markings during any phase of construction and relocate as indicated. Remove as specified in PennDOT Publication 408, Specifications, Section 963.3. Do not remove traffic lines and markings without a paint truck present on the project site if repainting is required.

3.12 LIFTING OF CONSTRUCTION MATERIALS
A. Stop traffic during the placement or removal of any construction materials that are above open lanes of traffic, such as, but not limited to, lifting equipment, bridge components, signs, and overhead sign structure components as directed.

3.13 NON-COMPLIANCE OF MAINTENANCE AND PROTECTION OF TRAFFIC
A. Non-Compliance of Maintenance and Protection of Traffic. Work zone liquidated damages will be assessed in the event the Contractor neglects or refuses to correct a situation or condition of non-compliance with Maintenance and Protection of Traffic requirements (TCP, Publication 212, Publication 213, and the MUTCD, or other contract traffic control requirements).

B. When deficiencies are found, a copy of the Work Zone Traffic Control Compliance Checklist and Notification Form, CS-901, will be delivered to the Contractor to correct the deficiencies as soon as possible. After receiving this notification the Contractor may
be assessed work zone liquidated damages if deficiencies are not corrected within the maximum time frames established below.

1. Traffic control devices for short term operations – 2 hours
2. Traffic control devices for long term operations – 24 hours, except for the following:
   a. Urgent
      1) Three or more consecutive channelizing devices – 2 hours
      2) Stop and Yield sign – 2 hours
      3) Arrow panels – 2 hours
      4) Attenuating devices – respond within 4 hours and complete repairs within 24 hours after notified the device is damaged

C. The base amount of work zone liquidated damages will be $1,000.00.

D. For long-term operations (as defined in Publication 213), an additional $100.00 assessment for each hour or portion thereof will be added to the $1000 base amount until the deficiency is corrected.

E. For short-term operations (as defined by Publication 213), an additional $100.00 for each hour or portion thereof will be added to the $1000 base amount until the deficiency is corrected.

F. Assessment of work zone liquidated damages will end when the Project Manager concurs that the deficiencies have been corrected.

G. If the Contractor remains in violation of the Maintenance and Protection of Traffic requirements, the Project Manager will direct SEPTA forces to correct the deficiencies and charge the Contractor for labor, equipment, and material costs incurred by the SEPTA or suspend work in accordance with PennDOT Publication 408, Specifications, Section 105.01(b) until the deficiencies are corrected.

3.14 CHANGEABLE MESSAGE SIGN

A. Furnish, operate, and maintain three-line or full matrix portable, trailer mounted, changeable message signs for traffic control as indicated or directed. Have all locations, messages, and times of operation approved by SEPTA Project Manager.

B. When providing telecommunications they must be capable of changing message or sequences of messages from a hand held device and/or personal computer, with the computer having calendar and time mode capability. Provide appropriate software for personal computer for the purpose of remotely operating the changeable message sign(s). For the duration of the project, provide a qualified technician familiar with the programming and operation of the changeable message sign. Designate the technician to be on call 24 hours a day, 7 days a week and to arrive on the project site within 3 hours of notification. Provide capability to monitor approaching vehicles via radar and display the vehicle’s speed on the message sign.

3.15 FLAGGER TRAINING

A. Provide flaggers that successfully completed a flagger-training course within the last 3 years that complies with PennDOT’s minimum flagger training guidelines described below. Assure that flaggers carry a valid wallet-sized training card containing the name of the flagger, training source, date of successful completion of training, and signature; or provide a roster of trained flaggers to the Project Manager before the start of flagging operations that contains the names of flaggers, training source, and date of successful completion of training. Minimum flagger training guidelines include the following:
   1. Minimum Course Contents
      a. Why flagging is important
      b. Fundamental principles of work zone traffic control
1) Component parts of the work zone
2) Channelization devices, spacing
3) Tapers
4) Buffer Space
5) Visibility to approaching drivers
c. Human factors – driver attitude, expectation, reaction
d. Qualifications of a flagger
e. Clothing
f. Flagger Operations
   1) Setting up the flagger station
   2) Signaling devices and when used
   3) Hand signaling procedure
   4) Communications
   5) Two-flagger operations
   6) Single flagger operations
   7) Flagging in intersections
   8) Nighttime flagging
   9) Emergency situations
g. Flagging in adverse weather conditions
h. Sign requirements
i. Practical exercise

2. Objectives – At the end of the course, the student should be able to
   a. Describe why flagging is important
   b. Describe flagger qualifications
   c. Ensure the flagger station complies with Publication 212, Publication 213, and the MUTCD
   d. Gather all necessary equipment
   e. Select the proper flagging station/position/location
   f. Control traffic using the stop/slow paddle
   g. Control traffic using the red flag
   h. Control two-way traffic in one lane of a highway
   i. Control traffic at an intersection
   j. Recognize and be able to control traffic in unique or special flagging situations
   k. Control traffic at night and recognize a safe nighttime flagging operation
   l. Communicate with co-workers and the public

3. Test
   a. All students must take and pass a written, closed book, knowledge test consisting of a minimum of 20 questions. Passing is 70%.

4. Re-training
   a. Re-training is required every 3 years.

3.16 SHADOW VEHICLE
   A. Load the truck according to the manufacturers recommendation. Place the shadow vehicle upstream of the construction area at the distance specified in PennDOT Publication 213 and the MUTCD, as directed.

3.17 TRAFFIC ALERT RADIO
   A. Furnish, place, program, operate, relocate, maintain, and remove a trailer mounted citizen band traffic alert radio as directed. Provide units from a source listed in PennDOT Bulletin 15 with a separate power source used solely to operate the information radio.
B. Locate the radio for clear reception in all directions from the project in order to allow drivers sufficient time to react. Drive through the project to determine limits of reception. Relocate the device as required.

C. Have all locations, messages, and times of operation approved by SEPTA Project Manager.

D. Messages are to be specific and confined to information related to unusual, temporary, or recurring highway or traffic conditions.

E. Upon project completion and/or when directed, remove the radio from the project.

3.18 EXISTING TRAFFIC SIGNAL ADJUSTMENTS

A. In the event it becomes necessary to turn off any existing signalization, provide flaggers, or other approved means, to direct traffic within the intersection during any period when the signals are not operating.

B. Obtain the approval of the SEPTA Project Manager and the municipality for any changes to the existing signalization, including timing, phasing, and operation adjustments. Obtain approval for planned changes at least 7 days before implementation, unless directed otherwise.

END OF SECTION 10020
SECTION 10030
POST MOUNTED SIGNS, TYPE A

PART 1– GENERAL

1.01 DESCRIPTION
A. This work is furnishing and installation of fabricated aluminum signs of the type indicated on steel S or W beam posts and breakaway system.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02120 – Clearing and Grubbing

1.03 SUBMITTALS
A. Contractor must submit catalog cuts of all proposed materials showing they are in accordance with the 100% Design Plans, Construction Specifications and Special Provisions.

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications
      b. PennDOT Publication 35, Bulletin 15, Approved Construction Materials

PART 2– PRODUCTS

2.01 MATERIALS
A. As shown on the Standard Drawings and as follows:
   1. Extruded Aluminum Channel Signs, Posts, and Miscellaneous Material.
      a. Extruded Aluminum Channel Signs— PennDOT Publication 408, Specifications, Section 1103.02
      b. Steel S or W Beam Posts and Breakaway System— PennDOT Publication 408, Specifications, Section 1103.07
      c. Galvanized Steel Hex Head Bolts, Nuts, Lock-Washers; Aluminum Post-Clips, Auxiliary Supports for Exit Panels, 1/8-inch Rivets— PennDOT Publication 408, Specifications, Section 1103.11
   2. Flat Sheet Aluminum Signs with Stiffeners, Posts, and Miscellaneous Material.
      a. Flat Sheet Aluminum Signs with Stiffeners— PennDOT Publication 408, Specifications, Section 1103.03
      b. Steel S or W Beam Posts and Breakaway System— PennDOT Publication 408, Specifications, Section 1103.07
      c. 1/8-inch and 3/16-inch Aluminum Rivets; Stainless Steel Bolts, Nuts, Washers, Post-Clips; Twist-In Toggle and Buckle Straps; Butting Plates;
3. Foundations
   a. Cast-In-Place Foundation
      1) Class A Cement Concrete – PennDOT Publication 408, Specifications, Section 704
      2) Reinforcement Bars – PennDOT Publication 408, Specifications, Section 709.1
   b. Steel Finned-Pipe Foundation
      1) From a manufacturer listed in Bulletin 15.

PART 3 – EXECUTION

3.01 GENERAL
   A. Erect posts plumb using a method that does not twist, bend, or otherwise deform the posts. Before erection, correct twisted, bent, or deformed posts. Erect signs by a method that does not twist, bend, or otherwise deform the signs. Level, correctly align, and then center signs on the posts and properly fasten. Exercise extreme care when using hoisting cables on the sign to avoid damage to the reflective sheeting. Repair or replace damaged posts and signs.
   B. Fasten the signs to the posts with the necessary hardware as detailed in TC 8700 Standard Series.

3.02 LOCATION
   A. The indicated location of sign installations is approximate with the exact location established at the site. Mark longitudinal and lateral location by stakes or paint marks with an identifying symbol.
   B. On tangent sections of roadway, locate and erect posts to allow signs to face away from roadway at an angle of 93 degrees from the pavement edge. On curves, locate and erect the posts perpendicular to the sight line, where the sight line is an imaginary line connecting the center of the near traffic lane. The length in feet from the sign to the center of the near traffic lane is equal to 40 times the letter height of the smallest legend in inches, but not less than 300 feet. For example: 50-inch x 12-inch letter equals a 600-foot sight line.

3.03 REMOVAL OF EXISTING SIGNS
   A. Remove existing signs or sign installations as indicated. Existing signs or sign installations that are permanently removed shall become the property of the Contractor unless indicated otherwise. Remove foundations to a minimum 12 inches below final grade.

3.04 CLEARING AND GRUBBING
   A. When directed, and as specified in Section 02120, remove material, brush, trees, or branches, which obstruct the clear view of signs being placed.

3.05 RESTORATION OF SITE
   A. Restoration of Site. Restore the site to its original condition, including the disposal of excess or unsuitable materials.
3.06 MOTORIST SERVICE SIGNS
A. Provide and install symbols, legends, and borders, with the exception of business logo signs, as indicated.

3.07 POSTS AND FOUNDATIONS
A. Posts
   1. Submit a sketch for acceptance for each plan location before post fabrication, showing the following:
      a. location of sign by plan station;
      b. lateral offset from pavement edge to sign edge;
      c. sign size (width and height);
      d. exit panel sign size (width and height);
      e. number of post supports and sections;
      f. post heights, measured from bottom of post base plate to post top;
      g. measured distance from reference line elevation at pavement edge to foundation top;
      h. steel finned pipe foundation design; or
      i. footing base type design and reinforcing steel; and
      j. bracket identification number and quantity.
   2. Replace galvanized parts or members damaged in transition or erection with new material having properly galvanized surfaces. Repair damage to galvanized surfaces that does not exceed 2% per linear foot of the total surface area according to ASTM A 780 and as specified in PennDOT Publication 408, Specifications, Section 910.3(r).

B. Foundations
   1. Cast-in-Place Foundations
      a. Excavate for the foundation, then position the posts and connections with the post flange faces aligned in the same plane. Place concrete against undisturbed earth, as specified in the applicable parts of PennDOT Publication 408, Specifications, Section 1001.3. Form the top 12 inches of foundations.
   2. Steel Finned-Pipe Foundations
      a. Install foundation and provide installation report prepared by Technical Assistant, according to the drawing and manufacturer’s recommendations.
      b. Technical Assistant. Provide a certified designer/installer to be present at the project site to assist the Contractor and Project Manager in the event that unusual problems or special circumstances arise. Furnish evidence of the designer/installer’s certification from the steel finned-pipe foundation supplier to the Project Manager before the start of work.

3.08 ERECTION
A. Install nuts on post clips with a torque wrench for extruded aluminum channels. Apply 225 inch-pounds of torque to each galvanized nut with the threads dry, clean, and unlubricated.
B. Attach the sign to posts with twist-in toggle and buckle straps or stainless steel post-clips for flat sheet aluminum. Apply 225 inch-pounds of torque to each stainless steel nut with the threads dry, clean, and unlubricated.
C. Clean signs after erection, removing any accumulation of oil, grease, dirt, or foreign material.
D. Brace the panel with one or more auxiliary supports if exit panels cannot be supported by two sign posts.
SECTION 10040
HOT THERMOPLASTIC PAVEMENT MARKINGS

PART 1– GENERAL

1.01 DESCRIPTION
A. This work is 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. Contract Agreement
B. Division 1 – General Requirements
C. Section 10020 – Maintenance and Protection of Traffic During Construction
D. Section 10090 – Plastic Contrast Pavement Marking

1.03 SUBMITTALS
A. Contractor must submit catalog cuts of all proposed materials showing they are in
accordance with the 100% Design Plans, Construction Specifications and Special
Provisions.

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest
edition and latest addenda thereto of the following publications to the extent referenced.
The publications are referred to in the text by the basic designation only.
1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
   a. PennDOT Publication 408, Specifications
   b. PennDOT Publication 35, Bulletin 15, Approved Construction Materials

PART 2– PRODUCTS

2.01 GENERAL
A. Provide materials from a source listed in PennDOT Bulletin 15. Certify materials as
specified in PennDOT Publication 408, Specifications, Section 106.03(b)3.

2.02 THERMOPLASTIC
A. AASHTO M 249. Provide a material listed in PennDOT Bulletin 15.

2.03 GLASS BEADS
A. PennDOT Publication 408, Specifications, Section 1103.14, Type A
B. Intermix
   1. Provide sufficient uncoated glass beads to comprise 40% of the marking material
      by mass (weight).
C. Surface-applied
1. Moisture resistant coated with a maximum of 5% passing the 180 µm (No. 80) sieve and a minimum of 70% rounds per sieve and a minimum of 80% rounds overall.

PART 3– EXECUTION

3.01 GENERAL

A. For proper adhesion, perform surface preparation of the road surface and provide the pretreatment according to PennDOT Bulletin 15 or recommended by the manufacturer. Clean the roadway surface where the hot thermoplastic pavement markings will be applied. Remove all surface treatment, laitance, curing compound, or any contaminants that would hinder adhesion. Clear any loose dirt and other debris from the application area. Surface preparation is incidental to the application of hot thermoplastic pavement markings, except for the removal of pavement markings which is performed and paid for under PennDOT Publication 408, Specifications, Section 963. Identify the location of the final pavement markings by applying spots on the pavement at 12 m (40-foot) intervals. The Inspector-in-Charge will approve the locations. Apply on dry pavement when the air and roadway temperatures are between 10 °C and 32 °C (50F and 90F) and when the wind speed is less than 32 km/h (20 miles per hour).

3.02 APPLICATION

A. Uniformly apply the markings at a minimum thickness of 2.3 mm ± 0.08 mm (90 mils ± 3 mils). A tolerance of ± 6 mm (± 1/4 inch) from the specified width will be allowed provided the variation is gradual and does not detract from the general appearance. For skip line patterns maintain a tolerance of ± 150 mm (± 6 inches) for each 12 m (40-foot) cycle and ± 75 mm (± 3 inches) for each 3 m (10-foot) skip line.

3.03 GLASS BEADS

A. Apply glass beads immediately after application of the markings at a minimum rate of 4.5 kg/9 m² (10 pounds per 100 square feet) of markings. Uniformly distribute glass beads on the surface. Provide markings with an average minimum initial retroreflectivity of 300 mcd/m²/lux for white and 250 mcd/m²/lux for yellow. Under the direction and supervision of the Project Manager, measure retroreflectivity with a 30-meter geometry retroreflectometer, conforming to ASTM E-1710 within 21 days after installation in accordance with PTM No. 431.

3.04 DEFECTIVE MARKINGS

A. Remove any markings placed incorrectly and replace them. Repair those markings, which after application and drying, are determined to be defective by the Inspector-in-Charge. Complete this work at no additional cost to SEPTA. Major problem areas and method of repair include the following:

1. Insufficient thickness or line width, uneven cross-section—Prepare defective material by grinding or blast cleaning to remove a substantial amount of beads and the marking surface is roughened. Remove loose particles and debris with compressed air. Restripe the cleaned surface as specified in PennDOT, Publication 408, Specifications, Sections 960.3(b) and (c).

2. Inadequate retroreflectivity, glass bead coverage or retention—Remove defective markings and clean pavement surface, including 300 mm (1 foot) beyond each end of the affected area. Remove loose particles and debris with compressed air. Restripe the marking on the cleaned surface as specified in PennDOT, Publication 408, Specifications, Sections 960.3(b) and (c).
3.05 GUARANTEE

A. Where directed, remove and replace material that has not remained within close conformity to location or has not remained effective in performing useful service in accordance with Section 107.16(b) for a period of 180 days from the date of acceptance. The minimum acceptable service is as follows:
   1. Longitudinal Markings
      a. 90% of material remains in each 305 m (1,000-foot) section of marking where the intersection unit is defined as material on an approach leg within 50 m (160 feet) of the intersection.
   2. Transverse Markings, Legends, and Symbols
      a. 90% of material remains for each individual legend, symbol, crosswalk, or stop line.

END OF SECTION 10040
SECTION 10060
PREFORMED THERMOPLASTIC PAVEMENT MARKINGS

PART 1– GENERAL

1.01 DESCRIPTION
   A. This work is the furnishing and installation of preformed thermoplastic pavement
      markings, of the type and color indicated

1.02 RELATED SECTIONS
   A. Contract Agreement
   B. Division 1 – General Requirements
   C. Section 10020 – Maintenance and Protection of Traffic During Construction
   D. Section 10090 – Plastic Contrast Pavement Marking

1.03 SUBMITTALS
   A. Contractor must submit catalog cuts of all proposed materials showing they are in
      accordance with the 100% Design Plans, Construction Specifications and Special
      Provisions.

1.04 QUALITY ASSURANCE
   A. Referenced Standards: The work covered in this Section shall conform to the latest
      edition and latest addenda thereto of the following publications to the extent referenced.
      The publications are referred to in the text by the basic designation only.
      1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
         a. PennDOT Publication 408, Specifications
         b. PennDOT Publication 35, Bulletin 15, Approved Construction Materials

PART 2– PRODUCTS

2.01 GENERAL
   A. Provide materials from a source listed in PennDOT Bulletin 15. Certify materials as
      specified in PennDOT Publication 408, Specifications, Section 106.03(b)3.

2.02 THERMOPLASTIC
   A. AASHTO M 249, Type 1, except that the material is in a preformed state. Provide a
      material listed in PennDOT Bulletin 15. Furnish a material with a minimum initial skid
      resistance of 50 British Pendulum Number (BPN) for all crosswalks, stop lines, legends,
      or where indicated.

2.03 GLASS BEADS
   A. PennDOT Publication 408, Specifications, Section 1103.14, Type A
PART 3– EXECUTION

3.01 GENERAL
A. At least 5 days before beginning work, provide the Inspector-in-Charge with a schedule of operations. In addition, provide the Inspector-in-Charge with the manufacturer’s instructions for the installation of the materials, application temperatures, proper mixing techniques, and any other data to ensure the material is being properly installed.

3.02 PRETREATMENT
A. For proper adhesion, perform surface preparation of the road surface and provide the pretreatment according to PennDOT Bulletin 15 or recommended by the manufacturer. Clean the roadway surface where the preformed thermoplastic pavement markings will be applied. Remove all surface treatment, laitance, curing compound, or any contaminants that would hinder adhesion. Clear any loose dirt and other debris from the application area. Surface preparation is incidental to the application of preformed thermoplastic pavement markings, except for the removal of pavement markings which is performed and paid for under Section 963. Identify the location of the final pavement markings by applying spots on the pavement at 12 m (40-foot) intervals. The Inspector-in-Charge will approve the locations. Apply on dry pavement when the air and roadway temperatures are between 10 °C and 32 °C (50F and 90F) and when the wind speed is less than 32 km/h (20 miles per hours).

3.03 APPLICATION
A. Apply markings, which have a minimum thickness of 3 mm ± 0.1 mm (125 mils ± 4 mils). A tolerance of ± 6 mm (± 1/4 inch) from the indicated width will be allowed provided the variation is gradual and does not detract from the general appearance. Use a heat gun to fuse the material to the pavement. Heat the material as recommended by the manufacturer.

3.04 GLASS BEADS
A. Surface apply glass beads as recommended by the manufacturer immediately after application of the markings. Uniformly distribute glass beads on the surface. Provide markings with an average minimum initial retroreflectivity of 300 mcd/m²/lux for white and 250 mcd/m²/lux for yellow. Under the direction and supervision of the Project Manager measure retroreflectivity with a 30-meter geometry retroreflectometer conforming to ASTM E-1710 within 21 days after installation in accordance with PTM No. 431.

3.05 DEFECTIVE MARKING
A. Remove any markings placed incorrectly and replace them. Repair those markings, which after application and drying, are determined to be defective by the Inspector-in-Charge. Complete this work at no additional cost to SEPTA. Major problem areas and method of repair include the following:
   1. Insufficient thickness or line width, uneven cross-section—Prepare defective material by grinding or blast cleaning to remove a substantial amount of beads and the marking surface is roughened. Remove loose particles and debris with compressed air. Restripe the cleaned surface as specified in this specification.
   2. Inadequate retroreflectivity, glass bead coverage or retention—Remove defective markings and clean pavement surface, including 300 mm (1 foot) beyond each end of the affected area. Remove loose particles and debris with compressed air. Restripe the marking on the cleaned surface as specified in this specification.
3.06 GUARANTEE

1. Where directed, remove and replace material that has not remained within close conformity to location or has not remained effective in performing useful service in accordance with PennDOT Publication 408, Specifications, Section 107.16(b) for a period of 180 days from the date of acceptance. The minimum acceptable service is as follows:
   a. Longitudinal Markings
      1) 90% of material remains in each 305 m (1,000-foot) section of marking where the intersection unit is defined as material on an approach leg within 50 m (160 feet) of the intersection.
   b. Transverse Markings, Legends, and Symbols
      1) 90% of material remains for each individual legend, symbol, crosswalk, or stop line.

END OF SECTION 10060
PART 1– GENERAL

1.01 DESCRIPTION
   A. This work is the removal of pavement markings and legends as detailed on the 100% Design Plans.

1.02 RELATED SECTIONS
   A. Contract Agreement
   B. Division 1 – General Requirements
   C. Section 10020 – Maintenance and Protection of Traffic During Construction

1.03 QUALITY ASSURANCE
   A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
      1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
         a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS
This Part not used.

PART 3– EXECUTION

3.01 CONSTRUCTION
   A. Remove existing pavement markings, as indicated, immediately before any change in traffic patterns or before the application of final markings. Remove markings that conflict with revised traffic patterns and may confuse motorists. Do not paint over existing lines with black paint.
   B. Remove markings for restriping to the extent that 90% of the material is removed without materially damaging or grooving the pavement surface more than 0.8 mm (1/32 inch). For all other marking removal, eliminate the markings to the extent that the marking is not visible to motorists when viewed from a distance of 15 m (50 feet). Remove waterborne pavement markings by sandblasting, grit blasting, steel shot blasting, or waterblasting. Grinding is acceptable only for the removal of thermoplastic, cold plastic, or epoxy marking materials. Obtain approval from the Project Manager for the proposed removal method before beginning work.
   C. Vacuum or collect residue, including sand, dust, and marking material, concurrently with the removal operation unless alternate procedure is submitted and accepted. Clean the area of dust with compressed air. Perform this work only in the area where the markings are to be applied. Do not allow sand, dust, or other residual material, which may
interfere with drainage or constitute a traffic hazard, to accumulate. Dispose of all residue in an acceptable manner.

D. Repair any pavement or surface damage caused during the removal process.

E. Prevent damage to transverse and longitudinal joint sealers, and repair any damage as specified in PennDOT, Publication 408, Specifications, Section 513.

END OF SECTION 10070
SECTION 10080
RESET POST MOUNTED SIGNS, TYPE A

PART 1– GENERAL

1.01 DESCRIPTION
A. This work is the removal of existing extruded aluminum channel signs or flat sheet signs, posts, anchors, foundations, and associated hardware and resetting the existing signs as indicated with new posts, anchors, foundations, and associated hardware.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements

1.03 SUBMITTALS
A. Contractor must submit catalog cuts of all proposed materials showing they are in accordance with the 100% Design Plans, Construction Specifications and Special Provisions.

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
   a. PennDOT Publication 408, Specifications

PART 2– PRODUCTS

2.01 MATERIALS
A. PennDOT Publication 408, Specifications, Section 930.2(a), except delete the first bullet; Section 930.2(b), except delete the first bullet; and Section 930.2(c).

PART 3– EXECUTION

3.01 CONSTRUCTION
A. PennDOT Publication 408, Specifications, Section 930.3 applies and as follows:
1. Remove existing signs, posts, anchors, and associated hardware as indicated. Remove existing foundations to a minimum depth of 300 mm (12 inches) below final ground surface, and backfill any holes in accordance with PennDOT Publication 408, Specifications, Section 206.3(b)4.
2. Stockpile signs for reuse. Dispose of existing anchors and associated hardware outside the right-of-way.
3. If specified or indicated, store existing posts for Department pickup. Otherwise, dispose of existing posts outside the right-of-way.
4. Provide new posts, anchors, foundations, and associated hardware to be set at the specified locations. Reset the existing signs.
5. Avoid damage to existing signs during the removal and stockpiling operations. Replace any sign lost or damaged as a result of any of the resetting operations, at no additional expense to the Department.

END OF SECTION 10080
SECTION 10090
PLASTIC CONTRAST PAVEMENT MARKINGS

PART 1– GENERAL

1.01 DESCRIPTION
A. This work shall consist of furnishing and installing 4" retro-reflective preformed patterned contrast pavement markings of the specified color, white or yellow, for surface application on concrete.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 10040 – Hot Thermoplastic Pavement Marking
    Section 10060 – Preformed Thermoplastic Pavement Markings

PART 2– PRODUCTS

2.01 GENERAL
A. The total width of the preformed contrast tape shall be 7". This additional 3" width shall be a black non-reflective film with 1 1/2" on both sides of the white or yellow film.

PART 3– EXECUTION

3.01 GENERAL
A. The surface shall be cleaned and primed in accordance with the manufacturer's recommendations prior to marking placement.
B. Markings shall be applied in accordance with the manufacturer's recommendations.
C. Markings shall be placed with adhesives and pressed into position in accordance with the manufacturer's requirements.

END OF SECTION 10090
PART 1 – GENERAL

1.01 DESCRIPTION
A. This work consists of jacking the bridge superstructure after deck placement in order to relieve stresses in the expansion neoprene bearing pads.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements

1.03 SUBMITTALS
A. Submit a plan showing and describing the jacking procedure for review and acceptance at least 2 weeks before proceeding with the jacking operations. Provide calculations showing actual and allowable bearing stresses in the bearing plates and bearing areas at the jacking locations. Have the plans and calculations sealed and signed by a Professional Engineer registered in the State.

PART 2 – PRODUCTS

2.01 MATERIALS
A. Furnish all materials, tools, and equipment necessary for performing the work.

PART 3 – EXECUTION

3.01 GENERAL
A. Reset expansion bearings after all dead loads have been placed. Before resetting, truck mixers and slip-forming equipment, necessary for placement of barriers and sidewalks, will be allowed on the structure. Do not allow other construction equipment or traffic on the structure until the bearings are reset. Coordinate the resetting operation with the installation of on-bridge hardware, including conduits, utilities, expansion dams, and drainage, to prevent damage to these components when the beams are jacked and lowered.
B. Furnish jacks with a working capacity at least equal to the jacking forces indicated. Jack beams at expansion bearings to achieve a 1/16-inch gap between the bottom of beam or sole plate and the top of the entire bearing pad. Place jack under the beam only where a jacking stiffener is provided as shown on the contract drawings. Unless indicated otherwise, jack all beams simultaneously. Limit the differential rise between all beams to 1/8 inch during jacking. After jacking, center the pad beneath the sole plate or beam bearing area as indicated. Lower the beams onto the bearings in the same manner as they were jacked.
C. Reset bearings when the ambient temperature is above 20F and below 85F.
SECTION 10100
STREET LIGHT POLE

PART 1—GENERAL

1.01 DESCRIPTION
A. This work is the furnishing and installation of a structure-mounted fiberglass street light pole and 6’ aluminum bracket.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 10110 – Street Light Pole Foundation
D. Section 10120 – Street Light Luminaire

1.03 SUBMITTALS
A. Submit, for approval before purchase, the following in accordance with Section 01300:
   1. Catalog cuts
   2. Drawings
   3. Manufacturer’s specifications

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications, Section 910 – Highway Lighting, and as follows.

PART 2—PRODUCTS

2.01 MATERIALS
A. Highway Lighting Material, in accordance with the attachment entitled “City of Philadelphia Standard Details”, as indicated, and as follows:
   1. Pole Shaft:
      a. Provide a 30’ long fiberglass pole with a smooth, uniform surface and an interior free of manufacturer processing residue and loose materials.
      c. Make the pole with an ultraviolet resistant resin pigmented throughout the entire thickness of the pole with the same color as the finish coat.
      d. Apply a highly weather resistant, pigmented, polyurethane coating to the pole having a minimum dry film thickness of 1.5 mils. Use the same color as the finish coat for the coating pigment.
   2. Anchor Base:
a. In accordance with the attachment entitled, “City of Philadelphia Standard Details”.

3. Bracket:
   a. 6’ length extending horizontally at 90 degrees to pole shaft (no rise) and as indicated in the attachment entitled, “City of Philadelphia Standard Details”.
   b. Install a one-inch (1”) grommet hole six-inches (6”) from the mounting plate on the bottom of the bracket.

4. Handhole:
   a. As indicated on the attachment entitled, “City of Philadelphia Standard Details”.
   b. Orient handhole 180 degrees from bracket.

5. Mounting Plate and Terminal Block:
   a. Have the manufacturer install the mounting plate as indicated on the attachment entitled, “City of Philadelphia Standard Details”.
   b. Provide a 12 point (6 over 6) insulated terminal block installed on the mounting plate for connection of service wire cable and luminaire service wire.

6. Grounding:
   a. No. 4 AWG structure ground wire, lugs and welds.

   a. Wind Deflection - Maximum 10% of the pole length based on an 80 mph wind (plus 30% gust) using a 15 EPA.
   b. Static Deflection - Maximum 1-1/2% static deflection due to weight of arm and luminaire.
   c. Permanent Set - Maximum 1% permanent deflection after release of test load equivalent to the wind loading calculated for wind deflection.
   d. Maximum Bending Moment - Calculated using maximum wind loading. Pole withstands two times this maximum bending moment.

8. Wiring:
   a. 12-2 UF with ground.

9. Testing Requirements:
   a. Sample poles are tested by manufacturer to determine actual bending and deflection values. The sample size is 5% of total order with a maximum of five (5) poles.
   b. Testing conforms to ANSI standards.
   c. Submit results to Street Lighting prior to shipment.
   d. Submit pole design calculations signed and sealed by a Professional Engineer registered in Pennsylvania, indicating compliance to applicable PennDOT and ASHTO specifications.

PART 3 – EXECUTION

3.01 CONSTRUCTION

A. Install fiberglass light pole onto foundation and secure to anchor bolts.
B. Leave all wrapping in place until pole, luminaire, and appurtenant material are installed and leveled. Store all materials in accordance with the manufacturer’s recommendation.
C. Remove post wrapping using zip string. The use of knives or razors is prohibited.
D. Bolt mounting plate to ground lug. Mount terminal block to mounting plate.
E. Wire new luminaire with 12-2 UF with ground wire. Provide sufficient slack in wires to facilitate maintenance.
F. Install wiring to connect the terminal block at the bottom of the pole to the photocell at the top of the pole.

G. Connect all ground wires to the ground lug and all feeds to terminal block. Ground pole base and grounding lug to existing ground rod.

H. Protection and care of the unit during shipment and installation is of utmost importance and it is the Contractor's responsibility to use all precautions and equipment necessary to install the unit in its original factory condition without scratches, abrasions, or any deformation of the finish.

I. Marred or damaged finish will be cause for rejection any time prior to acceptance by the Representative.

J. Touch-up minor scratches in the field using a method approved by the Representative.
SECTION 10110
STREET LIGHT POLE FOUNDATION

PART 1– GENERAL

1.01 DESCRIPTION
A. This work will consist of the construction of a concrete street light foundation with a 15” bolt circle as indicated on the plan or as directed by the Engineer.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 03300 – Cast-in-Place Concrete
D. Section 10100 – Street Light Pole
E. Section 10120 – Street Light Luminaire

1.03 SUBMITTALS
A. Submit, for approval before purchase, the following in accordance with Section 01300:
   1. Catalog cuts
   2. Drawings
   3. Manufacturer’s specifications

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications, Section 910 – Highway Lighting, and as follows.

PART 2– PRODUCTS

2.01 MATERIALS
A. Class A Concrete:
   1. As per Section 03300 – Cast-in-Place Concrete
B. Anchor Bolts:
   1. In accordance with the attachment entitled “City of Philadelphia Standard Drawings.”
C. Anchor Bolt Nuts and Washers
   1. In accordance with the attachment entitled “City of Philadelphia Standard Drawings.”
D. Grounding
   1. The grounding rod will be copper clad, 10’ in length and ¾” in diameter.
2. The resistance of the grounding rod must be tested in accordance with the National Electric Code (NEC) and must be less than 10 ohms in accordance with Streets Department requirements. For grounding rods failing the above-mentioned test, the Contractor will relocate the grounding rod to a suitable location approved by the Engineer.

PART 3– EXECUTION

3.01 CONSTRUCTION

A. The foundation will be constructed in accordance with Streets Department Standard Drawing #SL0102 attached and PennDOT Publication 408, Specifications, Section 910.

B. The Contractor will be responsible for the location of all subsurface structures and utilities in the construction area.

C. The foundation site will be excavated to the required dimensions, without placement of shoring or forms. If the presence of subsurface utilities prevents the construction of a foundation of the specified size, the Contractor will suspend work immediately and notify the Engineer.

D. The existing concrete footway will be removed to the nearest joint.

E. The excavation will be securely covered after completion and remain covered when no work is in progress. The excavation will be kept reasonably dry and free of mud until placement of the concrete.

F. The concrete foundation will be monolithic in construction and brought to a height of 2” above grade.

G. Four (4) anchor bolts will be set by template to the proper dimensions in accordance with Standard Drawing #SL0102 attached.

H. The Contractor will construct forms to firmly hold the template and anchor bolts in place while the concrete is poured. Each anchor bolt will extend 3” above the finished grade of the foundation.

I. If the anchor bolt is damaged prior to the pole installation, an acceptable method of correction must be approved by the Engineer.

J. A 10’ grounding rod will be installed in the foundation and extend 6” above the surface of the foundation.

K. The concrete foundation will be monolithic in construction and will cure for a minimum of 7 days prior to pole installation.

L. Construct a ¼” thick expansion joint with filler between the foundation and adjacent sidewalk/curb to the full depth of the sidewalk/curb.

M. The adjacent sidewalk and curb will be restored to its original condition.

N. Excessive damage to the existing pavement caused by the Contractor, as determined by the Engineer, will be corrected at the Contractor’s expense.
DENOTES EXPOSED TO VIEW FACE FINISH

COLUMN BASE PLAN

END OF SECTION 10110
SECTION 10120
STREET LIGHT LUMINAIRE

PART 1– GENERAL

1.01 DESCRIPTION
A. This work is the furnishing and installation of street light luminaire, as specified and as indicated.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 10100 – Street Light Pole
D. Section 10110 – Street Light Pole Foundation

1.03 SUBMITTALS
A. Submit, for approval before purchase, the following in accordance with Section 01300:
   1. Catalog cuts
   2. Drawings
   3. Manufacturer’s specifications

1.04 QUALITY ASSURANCE
A. Referenced Standards: The work covered in this Section shall conform to the latest edition and latest addenda thereto of the following publications to the extent referenced. The publications are referred to in the text by the basic designation only.
   1. Commonwealth of Pennsylvania Department of Transportation (PennDOT):
      a. PennDOT Publication 408, Specifications, Section 910 – Highway Lighting, and as follows.

PART 2– PRODUCTS

2.01 MATERIALS –
A. In accordance with PennDOT Publication 408, Specifications, Section 910.2 except as follows:
B. General: LED 179 Watt, cobra-type luminaire; die-cast aluminum housing, dark brown outside finish, National Park Service Brown, Federal Color #20040, two-door optical assembly, and top-mounted NEMA photocontrol receptacle, conforming to all applicable ANSI Standards for roadway lighting equipment.
C. Optical Assembly: Acrylic plastic refractor, hinged refractor holder with latch; high polish aluminum reflector; permanent polyester felt gasket; adjustable, mogul base, porcelain socket, factory-set for specified photometric distribution.
D. Ballast Assembly: Lag-type magnetic regulator ballast, capacitor, and plug-in starting aid, mounted on removable power door. Starter to provide a high voltage starting pulse in accordance with ANSI requirements for LED lamps. Ballast operation to conform to
Lamp Voltage-Wattage Limits of the ANSI trapezoid for LED lamps. HPF (min. 90 percent (90%)), OCV 195v min.

E. Slipfitter: Adjustable up to 2-inch tenon with support length of 5 inches; include a guard to prevent entrance of birds. Provide in-line fuseholders, single pole, water resistant, non-breakaway, polarized UL listed; and Class CC fuses, 600 volt, 5 amperes

F. LED Lamp:
1. System rating L75 at 50,000 hours.
2. 120v, 1050mA drive current.
3. PE function – PE Rec.
4. 4000K LED color temp., 17,200 typical initial lumens.
5. Asymmetric Forwardphotometric type,

G. Photocontrol:
1. Photosensor: Encapsulated phototransistor
2. Provide ANSI Standard C136.10 solid-state circuitry, three-pole, twist-lock photocell with the following characteristics:
3. Turn-on light level: 0.75 to 1.25 fc
4. Turn-off light level: 1.00 to 1.50 fc
6. Operating Temperatures: -40ºF to 150ºF
7. Relay load rating: 1800 VA
8. Power Consumption: 1.2 Watt Average
9. Method of Failure: Fail-off
10. Housing Cover: High impact Noryl colored green
11. Housing Marking: Year of installation permanently marked

H. Electrical and Photometric Specifications:
1. 120v - 277v LED
2. System power factor > 90%
3. THD< 20%
4. Class “A” sound rating
5. Internal surge protection –
   a. 90 Joule (4,500 Amps) MOV
   b. 160 Joule (6,500 Amps) MOV
   c. 2 160 Joule (10-13,000 Amps) MOV
   d. 320 Joule (13,000 Amps) MOV
6. EMI – Title 47 CFR Part 15 Class A
7. Photoelectric sensor – matched for 120v - 277v

PART 3– EXECUTION

3.01 CONSTRUCTION

A. In accordance with PennDOT Publication 408, Specifications, Section 910. 3 and as follows:

B. Install in accordance with manufacturer’s recommendations.

C. Coordinate with PECO to connect electrical service.

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END OF SECTION 10120
SECTION 13090
UNDERPINNING OF EXISTING RETAINING WALL AND BUILDING FOUNDATIONS

PART 1– GENERAL

1.01 DESCRIPTION
A. The work specified in this Section consists of the design and construction of bracing, shoring and underpinning systems to support existing retaining wall located at the Southeast corner of the 48th and Woodland Playground/Park, and building foundations located at 4751 Woodland Avenue (Southwest corner), and 4720 Woodland Avenue (Northeast corner).
B. Temporary bracing of the structure or portions of the structure as required to prevent the structure from becoming unsafe during construction.
C. Temporary shoring of portions of the structure as required to prevent the structure from becoming unsafe during construction.
D. Temporary shoring of excavations.
E. Construction and removal of posts, timbers, lagging, braces, etc. required in connection with bracing, shoring, and underpinning the structure during construction.
F. Excavation, concrete placement and backfilling required in connection with underpinning foundations.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 – General Requirements
C. Section 02070 – Selective Demolition - Bridge
D. Section 02072 – Selective Demolition - Roadway
E. Section 02160 – Excavation Support and Protection
F. Section 02170 – Vibration Monitoring and Condition Survey
G. Section 02200 – Earthwork
H. Section 02220 – Excavation, Backfill and Compaction
I. Section 02225 – Class 1, Class 1 A, and Class 1B Excavation

1.03 SUBMITTALS
A. Submit the following in accordance with Section 01300:
   1. Shop Drawings indicating layout, member sizes, connection details and construction sequence for bracing, shoring and underpinning. No work related to bracing, shoring or underpinning shall take place until the Project Manager has reviewed the Shop Drawings.
   2. Design calculations of bracing, shoring and underpinning showing member stresses and connections due to imposed loads.
   3. Construction sequence and proposed construction method(s)

1.04 QUALITY ASSURANCE
A. Design calculations and Shop Drawings of proposed bracing, shoring and underpinning of the structures shall be prepared, stamped, and signed by a Structural Engineer registered in the Commonwealth of Pennsylvania.

1.05 DEFINITIONS

A. Restoration is defined as the correction, by repair or replacement, of portions of a structure damaged or altered as a result of the Contractor's operations. Restore to the equivalent condition existing prior to the start of work and to the satisfaction of the Project Manager.

B. Structures are defined as buildings, retaining walls, railroad tracks, above surface and underground structures, including pavements and underground pipelines and utilities that may be affected by the Contractor's operations.

1.06 PROJECT CONDITIONS

A. The Contractor is advised that structures are located close to the proposed work and that construction activities shall be conducted so as to preclude damage to same.

B. The Contractor shall be responsible for installing bracing, shoring and underpinning for the structures adjacent to the bridge as follows:
   1. Existing building structure at 4720 Woodland Avenue (Northeast corner) will require shoring.
   2. Existing retaining wall structure at southeast corner of 48th & Woodland Playground/Park will require underpinning.
   3. Existing building structure at 4751 Woodland Ave (Southwest corner) will require underpinning.

C. The Contractor shall be responsible for leaving bracing, shoring and underpinning in place or partially removing it at the end of construction such that the site can be fully restored to the pre-construction condition or final graded condition per the plans.

D. The Contractor shall be responsible for any damage caused by construction activities.

E. Damage to such structures or to any persons or property associated with such structures, where such structures are or are not shown on the Contract Drawings, is the responsibility of the Contractor.

F. The Contractor shall be responsible to pay for restoration of such damaged structures back to equivalent original condition at no expense to SEPTA.

1.07 DESIGN REQUIREMENTS

A. General: The stability and integrity of the structure during construction shall be maintained at levels generally acceptable within the construction industry by the use of bracing, shoring, and underpinning. In no case shall the structure be allowed to become unsafe during construction as defined by the local governing jurisdiction. Design stresses in bracing, shoring, and underpinning shall not exceed the allowable stresses in AISC-LRFD and ACI latest editions.

B. Bracing and Shoring for Structures:
   1. The bracing and shoring systems required to provide temporary support of a structure or portions of a structure during construction shall be designed to support the dead, live, soil, earthquake and wind loads that may be imposed on the structure during construction in accordance with industry standards and generally accepted engineering principles.
2. The proposed bracing and shoring systems shall have foundations designed for allowable soil bearing pressures in accordance with the geotechnical investigation prepared for the Project.

C. Shoring of Excavations and Underpinning: The proposed shoring and underpinning systems shall be designed for earth pressures and allowable soil bearing values as applicable in accordance with the geotechnical investigation prepared for the Project.

PART 2– PRODUCTS

2.01 MATERIALS FOR SHORING AND BRACING

A. Materials for shoring and bracing shall be undamaged, high quality materials.

B. Provide certification or laboratory test results verifying material properties. For used steel, the salvage design values from AASHTO Guide Design Specification for Bridge Temporary Works (AASHTO Guide Spec) may be used as an alternate to testing to determine grade of steel. Materials need not be new but must be in serviceable condition as determined by the Representative. Temporary material used does not have to be from a Bulletin 15 source, but must meet the following:

1. Structural Steel - AASHTO M 270M/270 (ASTM A709M/A709) Grade 250(Grade 36), Grade 345(Grade 50) or Grade 345W(Grade 50W)
2. Steel Sheet Piling - ASTM A328M/A328, ASTM A572M/A572
3. Steel H-Piles - AASHTO M 270M/270 (ASTM A709M/A709), Grade 250(Grade 36)
5. Cement - AASHTO M85 and AASHTO M240
6. Pre-Stressing Steel - ASTM A416 Grade 270
7. Welding Wire Fabric - AASHTO A55 (ASTM A185)
8. Reinforcement Bars - AASHTO M 31M/31 (ASTM A615M/A615), AASHTO M42M/M42 (ASTM A616M/A616), Grade 420(Grade 60)
9. Other Material - In accordance with applicable Sections of Publication 408

2.02 CONCRETE FOR UNDERPINNING

A. Concrete for underpinning shall meet the requirements of Section 03300 Cast in Place Concrete.

PART 3– EXECUTION

3.01 CONSTRUCTION

A. Construction of bracing, shoring and underpinning shall be in accordance with the reviewed Shop Drawings prepared by the Subcontractor's Engineer.

B. The Subcontractor shall hire the Engineer responsible for the design of bracing, shoring and underpinning and inspection of the work as detailed on the bracing, shoring and underpinning Shop Drawings, prior to sawcutting or removing portions of the structure.
C. Excavations for underpinning the foundations shall be inspected by a Geotechnical Engineer prior to placement of concrete.

D. The Engineer responsible for design of bracing, shoring and underpinning shall write a letter to the Project Manager certifying that construction of bracing, shoring and underpinning was completed in accordance with the bracing, shoring, and underpinning Shop Drawings and meets its approval, prior to placement of concrete, sawcutting, and removal or modification of portions of the structure.

E. Remove surplus excavated materials from site.

3.02 REMOVAL OF BRACING AND SHORING

A. Bracing and shoring shall not be removed until the new members have acquired sufficient strength to support their weight and the loads superimposed thereon safely. In no case may bracing or shoring be removed until the time and sequence has been approved by the Engineer responsible for bracing and shoring and reviewed by the University.

B. In general, bracing and shoring of concrete shall remain in place for at least ten days, when they may be removed provided the concrete is sufficiently hard and will not be injured

END OF SECTION 13090
SECTION 16060
GROUNDING AND BONDING

PART 1 – GENERAL

1.01 DESCRIPTION
A. This Section specifies the requirements for furnishing, installing and testing of the grounding and bonding system for the permanent Woodland Avenue Bridge. In addition, the Contractor is responsible for designing and constructing the Grounding and Bonding plans/details for all temporary works and permanent metal bridge components in the temporary condition including but not limited to: rebar cages, beams, aluminum barriers, fences, etc.

1.02 RELATED SECTIONS
A. Contract Agreement
B. Division 1 - General Requirements

1.03 SUBMITTALS
A. The following items shall be submitted by the Designer/installer:
   1. Manufacturer's data on cable, connectors, weld material, and tools.
   2. Plans showing location of the grounding cables and their connection to the bridge structure, temporary jacking structures and static wire or catenary structure.
   3. Grounding wire continuity test reports.
   4. As-built drawings showing any deviations or modifications from the design.
   5. Shop drawings of any custom shop or field fabricated equipment.
   6. Temporary works grounding and bonding plans, specifications, and catalog cuts.

1.04 QUALITY ASSURANCE
A. Bridge grounding system shall be designed, manufactured and installed by the designer/installer to conform to the requirements of this Specification, the Contract Drawings, and the latest edition of the following codes, regulations and standards:
   1. Underwriters Laboratories (UL) listings and approvals on specified products
   2. American National Standards Institute (ANSI)
   3. American Society for Testing and Materials (ASTM) Standards
   5. National Electrical Code (NEC)
   6. Southeastern Pennsylvania Transportation Authority (SEPTA) Standards
B. Broken, cracked, chipped or impaired length of cables will not be acceptable.
C. Designer/installer shall maintain written copies of all grounding procedures in the field at all times during the work.
PART 2 – PRODUCTS

2.01 MATERIALS

A. Grounding cable shall be annealed, concentric stranded, bare copper cable of the size shown on the Contract Drawings, and comply with the requirements of ASTM B8.

B. Grounding cable connections to the bridge or catenary support structural steel shall be mechanically connected as developed by the designer/installer.

C. Grounding cable connections to the static wires shall be made by the copper wedge type connectors.

D. Wedge type connections shall be AMP Co. or approved equal. Wedge type connectors shall be installed using tools supplied by the manufacturer of the connector.

E. All grounding cable connections shall have current-carrying capacity at least equal to that of the copper cable with which they are used.

2.02 GENERAL REQUIREMENTS

A. Final product acceptance shall not occur until after the installation and successful testing of the ground system.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All grounding connections shall be installed according to the manufacturer’s specifications and recommendations. Paint, scale, rust, corrosion, concrete encasement and other foreign matter shall be removed from sufficient area around the points of contact on metal surfaces before the ground connections are made. All removed paint shall be restored to match original color after completion of the grounding connection.

B. Installation of the bridge grounding shall precede all structural rehabilitation work.

C. Precautions shall be taken to ensure that no damage is done to the grounding conductors or connections during excavation, backfilling, compacting, or concreting operations. Any element of the bridge grounding system damaged during structural rehabilitation work shall be immediately replaced.

D. Exposed grounding conductors shall be supported on bridge surfaces with non-corrosive hardware manufactured of Everdur metal or equal, with the maximum interval of 48 inches.

E. Buried grounding cables crossing under the railroad tracks shall be protected by fiberglass conduit. The conduit shall be buried at least fifteen inches below the top of the ties and extend at least twelve inches beyond the end of the ties.

F. Splices or joints in the grounding cable are not permitted.

3.02 INSPECTION AND TESTING

A. The following inspections and tests shall be performed on the grounding system prior to and after the bridge rehabilitation work and while temporary jacking structures are in place:

1. Resistance from temporary steel and permanent steel to earth ground, to nearest of 100 milliohms or better, and shall conform to requirements of IEEE standard 81

2. Inspection of all grounding wire connections to the bridge and catenary support structural steel, and to the static wire.
3. Continuity tests for all grounding conductors.

B. Perform final verification of final grounding after the completion of construction.

END OF SECTION 16060
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SECTION 16311
OVERHEAD CONTACT SYSTEM INSTALLATION

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Specification Section covers work performed by SEPTA for the installation of the overhead catenary system and the associated overhead static wire, signal power conductors, and installation of fittings and hardware at the support structures.

B. The catenary system comprises conductors as described herein complete with hangers, jumpers, feeders, in-span insulators, termination assemblies, deflector arrangements, and all associated in-span fittings necessary to complete each wire run as determined by the Designer/installer and as shown on the Design Drawings to be developed by the Designer/Installer as part of this contract.

C. The signal power conductor comprises conductors as described herein complete with termination assemblies and all clamps, supports, insulators and connections necessary to install the signal power conductors including signal power transformers and disconnects.

D. The static wire comprises conductors as described herein complete with termination assemblies and all clamps and connections necessary to connect all the catenary structures to aerial static wires bonded to the structural steel supports and connected to the SEPTA ground bus at MORTON substation.

1.02 SUBMITTALS

A. At least thirty days prior to commencing the work of this Section, SEPTA will notify and coordinate with the Contractor regarding the schedule and access requirements for the Overhead Contact System Installation.

PART 2 – PRODUCTS

2.01 MATERIALS

A. SEPTA shall design, furnish and install all conductors, hardware, insulators, jumpers, section insulators, etc. necessary to complete the work in accordance with the design as determined by the Designer/Installer as shown on the Design Drawings to be developed by the Designer/Installer as part of this contract, this specification, and the agreed Construction Schedule.

PART 3 – EXECUTION

3.01 INSTALLATION OF STATIC WIRE AND SIGNAL POWER WIRE

A. The installation procedure for the aerial static wire and the signal power wires will be similar to that used for the catenary messenger. The conductors will be pulled out under tension and must not be allowed to come into contact with vehicles or the ground.

B. The static wire is to be connected to the ground bus at MORTON substation.

3.02 INSTALLATION OF CATEenary
A. Following the installation of the new support structures, assemblies and down guys, the Catenary Installer shall install the individual tension lengths of catenary by stringing the conductors and installing the hardware, in-span insulators and the section insulators in accordance with the design as determined by the Designer/Installer as shown on the Design Drawings to be developed by the Designer/Installer as part of this contract and this Specification. This work shall be undertaken in accordance with an agreed Overhead Contact System Installation Plan.

B. The individual tension lengths of catenary conductor shall be pulled out under tension. During the stringing process the conductor shall not come into contact with either the ground or any work vehicle.

C. Care shall be taken to avoid kinking, twisting and other damage during stringing. Particular care shall be taken to ensure the wires do not become birdcaged or abraded in any way.

D. Splices are to be minimized in all overhead conductors and if unavoidable, must have the approval of the Project Manager.

E. After final adjustment of the catenary, turnbuckles and other adjustable fasteners shall be at their median position to provide for future maintenance.

F. Section insulators are to be designed and installed as determined by the Designer/Installer and as depicted in the positions shown on the Design Drawings to be developed by the Designer/Installer as part of this contract and in accordance with the manufacturer's instructions.

G. The Catenary Installer shall adjust the length of the supporting hangers for the section insulator assemblies to insure that the frame and runners for these assemblies are set parallel to the plane of the top of the rail. The Catenary Installer shall check the contact wire profiles and insure a smooth pantograph take-over across the section insulators.

3.03 TENSIONING OF DOWN-GUYS

A. As installation of the catenary, ground, and feeder wires proceeds, each down-guy shall be progressively re-tensioned if required so that the pole to which the guy or guys are attached remains vertical, or to rake as determined by the Designer/Installer.

3.04 INSTALLATION TOOLS

A. The Catenary Installer shall provide and maintain sufficient tools, mechanical equipment and apparatus necessary to complete the work in accordance with the Design Drawings prepared by the Catenary Installer and an agreed Overhead Contact System Installation Plan. This equipment shall include suitable dynamometers or other measuring devices which will accommodate a minimum of 7,500 pounds tension and are calibrated in increments of not more than 50 pounds. The Catenary Installer shall also provide suitable high-grade contact thermometers for measuring the conductor temperatures in the section where the conductors are being tensioned and any special tools recommended by the manufacturer for installing the section insulators.

3.05 CONSTRUCTION TOLERANCES

A. The following construction tolerances shall not be exceeded, except at the discretion of the Project Manager.

1. Plus or minus two inches on the lengths of the in-span catenary hanger assemblies as indicated on the Design Drawings to be prepared by the Catenary Designer/installer.

2. Plus or minus six inches on the location of the in-span main catenary hanger assemblies indicated on the Design Drawings to be prepared by the Catenary Designer/installer.

3. Plus or minus one inch on the heights of the contact wire above top of high rail indicated on the Design Drawings to be prepared by the Catenary Designer/installer.
4. Plus or minus one inch on the staggers indicated on the Design Drawings to be prepared by the Catenary Designer/installer. Stagger shall be the perpendicular distance from the contact wire to the track centerline, projected normal to the plane of the track to the height of the contact wire.

5. Plus or minus one inch on the system heights indicated on the Design Drawings to be prepared by the Catenary Designer/installer. System heights shall be the vertical distance from the contact wire to the messenger wire at the point of support of the catenary.

6. Placing of Catenary support structures shall be located within plus or minus one foot of the Design Drawings to be prepared by the Catenary Designer/installer.

3.06 COMPLIANCE TESTING

A. The Catenary Installer shall perform compliance testing of the overhead contact system witnessed by the Project Manager in accordance with an agreed Compliance Testing Program.

B. All compliance test results shall be recorded and promptly submitted to the Project Manager in the agreed format.

C. Mechanical properties tested shall include:
   1. Support structure setting elevations.
   2. Pole vertical tolerances.
   3. Catenary hanger lengths.
   4. Catenary hanger locations.
   5. Contact wire heights.
   6. Contact wire staggers.
   7. Catenary system heights.

D. A catenary height and stagger gauge will be provided by the Catenary Installer for performance of the compliance testing.
SECTION 16312
CATENARY FITTINGS AND HARDWARE

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work specified in this Section will be performed by SEPTA, and consists of furnishing and installing fittings and hardware for the catenary and catenary support structures.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

   b. A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   c. A473 Stainless and Heat-Resisting Steel Forgings.
   e. A536 Ductile Iron Castings.
   f. A668 Steel Forgings, Carbon and Alloy, for General Industrial Use.
   g. A711 Carbon and Alloy Steel Blooms, Billets and Slabs or Forgings.
   h. B99 Copper-Silicone Alloy Wire for General Purposes.
   j. B248 General Requirements for Wrought Copper and Copper-Alloy Plate, Sheet, Strips and Rolled Bar.
   k. B249 General Requirements for Wrought Copper and Copper-Alloy Round Bar and Shapes.
   l. B548 Copper Alloy Sand Castings for General Applications.

1.03 SUBMITTALS

A. At least thirty days prior to commencing the work of this Section, SEPTA will notify and coordinate with the Contractor regarding the schedule and access requirements for the Catenary Fittings and Hardware Installation.

1.04 DESIGN TO PERFORMANCE REQUIREMENTS

A. Job Conditions: The dimensions and conditions shown on the drawings are based upon the best data available at the time the drawings were prepared. The Catenary Designer/Installer shall verify all field dimensions and existing conditions pertinent to the execution of the work before work is started or material is fabricated.

1.05 QUALIFICATIONS

A. The Catenary Installer shall furnish certification from the manufacture(s) verifying that the Fittings and Hardware have been manufactured, inspected, and tested in accordance with the specified standards.

B. All hardware to consist of “proven” items, with a list of project names and locations where they have been installed

1.06 FIELD SAMPLES

A. The Catenary Designer/Installer shall provide to SEPTA, for testing purposes, a sample of components proposed as a substitute.
PART 2 – PRODUCTS

2.01 MATERIALS

A. Malleable Iron: ASTM A47, Grade 32510; galvanized, ASTM A153.
B. Forged Steel: ASTM A711 or A668; galvanized, ASTM A153.
C. Cast Iron: ASTM A518, Corrosion resistant; high-silicone cast iron.
D. Ductile Iron: ASTM A153, Grade 60, 40, 18 or better; galvanized.
E. Bronze Casting: ASTM B148, Alloy C95800 or ASTM B584, Alloy C90300 or C92200, and as follows:
   1. Provide with smooth, even finish, free of blow holes.
   2. Castings shall conform closely to pattern and shall be full size. Diameter of cored holes shall not vary more than 1/32 inch from the size given on the Drawings, and all holes shall be accurately placed. Where permitted by SEPTA, distances between holes in general may vary not more than 1/8 inch from the dimensions given on the Drawings.
   3. Sockets to receive other hardware shall be carefully formed, shall conform closely to the Drawings and shall accurately fit, with proper clearance to the parts to be received.
   4. Identification marks or numbers shall be cast on all castings, such raised working marks shall be kept intact and shall show plainly on all finished castings.
   5. Chemical analysis and tension testing is required for each lot in accordance with the applicable ASTM standards.
F. Bronze Rod: ASTM B99, Alloy C65100, Temper H01; threads may be cut or rolled.
   1. Tests:
      a. Twist tests shall be made upon samples 10 inches in length between jaws. Rods shall bend through an angle of 360 degrees about their own diameter, without a sign of cracking.
      b. Tensile and Elongation Tests:
         1) Tensile and elongation tests shall be made upon one sample of rod selected by SEPTA from each lot of 200 rods.
         2) The elongation of the specimen shall be determined as the permanent increases in length due to the breaking of specimen in tension, measured between gage marks originally placed upon the specimen 10 inches apart. The fracture shall be between the gage marks and not closer than 1 inch to either gauge mark.
         3) Special Test: When considered necessary by SEPTA, material to be used in cold working operation shall be subjected to the following test: The rod shall be cold-headed at both ends to the form intended for use. The heads thus formed shall develop the full specified strength of the rod. Heads shall not crack when struck by a sharp blow with a hammer.
G. Stainless Steel Carriage Bolts and Nuts: material shall be 300 series, threads shall be rolled. Nuts shall develop the full strength of the threaded section of the bolt.
   1. Tests:
      a. Tensile and Elongation Tests: Tensile and elongation tests shall be made upon one sample of bolt stock selected by SEPTA from each billet. Bolts shall develop a tensile strength at the net section of the thread equal to that specified for the material. Nuts shall be made of similar material and shall develop the full strength of the threaded section.
      b. "Nick and Break" Test: The two ends of the bolt stock formed from a bronze billet which is to made into bolts covered by this specification shall be given a "nick and break" test to determine whether there are "pipes" in the stock. By "pipe" is meant a separation of the material within the bolt stock which may have been caused during the pouring of the billet. "Pipes" shall not be acceptable.
c. Special Test: When considered necessary by SEPTA, material to be used in cold working operation shall be subjected to the following test: The rod shall be cold-headed at both ends to the form intended for use. The heads thus formed shall develop the full specified strength of the rod. Heads shall not crack when struck a sharp blow with a hammer.

H. Copper: ASTM B248 or B249.

I. Fasteners used for grounding and bonding systems shall be of high-copper alloy, Everdur, Durium, Duronze, or silicone bronze, or equal. Ferrous hardware will not be acceptable.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install fittings and hardware in accordance with the manufacturer's instructions and the details shown on the Contract Drawings.

B. Compression tools for installation of end fittings shall be as specified by the manufacturer of the fittings.

END OF SECTION 16312
PART 1 – GENERAL

1.01 DESCRIPTION

A. The work specified in this Section will be performed by SEPTA for the following:
   1. Furnish equipment and provide protection to workers and the railroad facilities in compliance with SEPTA electric traction (ET) department requirements.
   2. Furnish all notices, schedules, materials, and labor for performing work in SEPTA's Electrified Territory.
   3. This Section includes the design, supply and installation of insulators for installation on steel catenary brackets. This work shall include the following:
      a. Messenger Support and Termination Insulators
      b. Trolley Support and Termination Insulators.

1.02 RELATED SECTIONS

A. Contract Agreement
B. Division 1 - General Requirements
C. Section 16060 - Grounding and Bonding

1.03 SUBMITTALS

A. At least thirty days prior to commencing the work of this Section, SEPTA will notify and coordinate with the Contractor regarding the schedule and access requirements for the installation of Insulators on the steel catenary brackets.
B. Submit the following in accordance with Section 01300.
   1. Complete description of contractor methods and procedures for performing the work, including the proposed sequence and staging of the work as it affects fouling or protecting ET facilities;
   2. For assemblies: List of values of BIL; ultimate tensile strengths; ultimate torsional strength; weights (including weight of components) and electrical characteristics.
   4. Certified factory test reports.
   5. The Catenary designer/installer shall submit Shop Drawings for review prior to insulator manufacture, showing details and dimensions of the insulating and metal parts, describing the material composing the various parts, together with technical, mechanical and electrical characteristics.
   6. The Catenary designer/installer shall prepare and submit a device loading table with calculations to indicate the maximum design loading occurring at each insulator location, and the type of insulator to be applied at each location.
   7. The Catenary designer/installer shall submit for review details of the tests proposed for each insulator and the procedures and forms to be used during tests and inspection.
8. Certification:
   a. The Catenary designer/installer shall provide certificates of compliance for the following:
      1) Steel analysis
      2) Hot dip galvanizing
      3) Adhesive materials
      4) Insulator materials
      5) In-service record of proposed insulators
      6) Certified Quality Control Procedures used in the manufacturing process

9. Data to be furnished by the Catenary designer/installer, prior to insulator installation:
   a. Insulators:
      1) Electrical
         a) Creepage length (inches)
         b) Insulation level (impulse withstand test voltage, kV)
         c) AC test voltage (kV).
      2) Mechanical
         a) Attachment centers and overall length (inches)
         b) Shed diameters (inches)
         c) Core diameters (inches)
         d) Break-down of weights, insulator and fittings (pounds)
         e) Tensile withstand load (pounds)
         f) Recommended maximum working tensile load (inch-pounds)
      3) A complete set of assembly, component, and detailed Contract Drawings showing dimensions and weights.
      4) Storage and handling instructions.
      5) Details of any specifications for materials included in the insulator assembly which are not covered in this Specification.

10. The Project Manager shall be informed at least two weeks in advance of the date on which insulators will be ready for inspection and tests.

1.04 DESIGN REQUIREMENTS
   A. General characteristics and usage of the insulators shall be as shown on the Contract Plans.
   B. Insulators shall be mechanically rated to meet or exceed the application loading requirements as shown on the Contract Plans. Insulators shall have a standard M&E strength of 20,000 lbs.
   C. The electrical rating for traction power insulators shall be suitable for safe, continuous operation of the 25 kV ac traction power system under all weather conditions pertaining to the railroad. As a minimum, the insulators shall have a BIL of 110 kV.
1.05 QUALITY ASSURANCE
   A. Employ a foreman having experience with installation of overhead contact systems (OCS). Submit qualifications to SEPTA for approval.

1.06 DELIVERY STORAGE AND HANDLING
   A. Deliver all products to the job site in a condition ready for installation. Furnish incoming material inspection reports for all products.
   B. Furnish off-site, secure, dry storage for all OCS products.
   C. Handle all products in such a way as to avoid damage, distortion, marring of finish, or surface contamination.

1.07 WORK BY OTHERS
   A. Temporary sectioning of the catenary for tracks 1& 2 by SEPTA to allow for work underneath de-energized catenary.

1.08 PROJECT CONDITIONS
   A. Execute the work with the minimum impact to active operations of the Railroad in the electrified territory over the two (2) tracks over the bridge as shown on the Contract Drawings.

PART 2 – PRODUCTS

2.01 CATENARY AND TRANSMISSION LINE INSULATORS
   A. Catenary and transmission line Insulators - For the support of trolley, messenger and feeder wires that comprise the catenary system. These shall be manufactured with suitable weathersheds of wet process porcelain (LAPP 008100 or equal) as shown in standard SEPTA assemblies such as “PO-1” or “PO-2”, for example.

PART 3 – EXECUTION

3.01 PROTECTION OF ET FACILITIES
   A. Coordinate the movement of all high-rail, hoist, or other fouling equipment with SEPTA, and procure the protection by SEPTA ET department personnel for rehabilitation work operations. Perform all the coordination work through SEPTA’s Project Manager.
   B. Conduct work and safety briefings at the beginning of each day, and verify field coordination with SEPTA ET department personnel before proceeding with the work.

3.02 INSTALLATION OF INSULATOR
   A. The insulators shall be installed in accordance with the manufacturer's instructions and as shown on the Contract Drawings.
   B. All tests shall be completed by the designer/installer team and all test reports accepted by the Project Manager prior to shipment of any insulators.
3.03 FACTORY INSPECTION AND TESTING

A. General: Conduct factory testing of units in accordance with the specified standards. The Project Manager reserves the right to witness all tests. Notify the Project Manager at least three weeks prior to the time and location of factory tests. Submit two copies of certified factory test reports to the Project Manager.

B. Perform routine tests: Routine mechanical tests on each insulator assembly as defined by ANSI C29.1, paragraph 7.2.1. For these tests, the proof test load may be applied directly to the end fittings of the insulator unit, instead of on the contact wire or the main frame of the catenary section insulator assembly. After mechanical tests are performed, each insulator unit shall be subject to a routine flashover test as defined by ANSI C29.1.

3.04 CLEANING

A. After confirming that catenary section is de-energized, ground the dead section of catenary.

B. Moisten the insulator with water to loosen the dirt on the insulator. Wet the rag with soap solution. Wipe and scrub the insulators until all dirt loosens up. Wash away all the soap from the insulators. Repeat the above process until the insulators are free of any dirt. Wipe insulators with smooth cloth and allow to dry.

3.05 FIELD TESTING

A. After installation of the permanent catenary system, by the Designer/installer, SEPTA’s Power Department will inspect and approve the installation prior to return to service. Designer/installer will be required to make necessary adjustments at no additional cost to SEPTA

END OF SECTION 16313
SECTION 16384
CATENARY FOUNDATIONS (NOT IN CONTRACT – BY OTHERS)

PART 1 – GENERAL

1.01 DESCRIPTION

A. The work included under this section includes provisions for furnishing and installing catenary structure foundations as called for in the Contract Drawings. This section specifies requirements for foundations constructed by drilling or otherwise excavating a shaft, inserting the steel reinforcement and filling it with concrete as indicated on the Drawings. The Work of this Section also includes but is not limited to the following:

1. Excavation, backfilling and disposal of existing obstructions encountered within the limits of the foundation construction, in accordance with the requirements of the Standard Specifications.
2. Disposal of excavated materials from the foundation locations. Excavated materials are to remain on SEPTA property at the drilling location(s) as determined and deemed acceptable by the SEPTA Project Manager.
3. Removal of concrete over pour or other irregularities which interfere with other structural elements, utilities, drainages or other planned construction.
4. The Contractor shall examine the site prior to submitting the bid to determine existing conditions.
5. The detailing, fabrication, and delivery of structural steel down guy embedded columns including all accessories and connection hardware, including grounding, as detailed on the contract drawings and as required for complete installation
6. Complete anchor bolt and embedment plate packages.

1.02 RELATED WORK

A. Section 01010 - Summary of Work.
B. Section 01300 – Submittals.
C. Section 02070 – Selective Demolition - Bridge

1.03 REFERENCES

A. Codes, Regulations, Reference Standards and Specifications:
1. AWS: D.1.1
2. AISC:
   a. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings
   b. Code of Standard Practice for Steel Buildings and Bridges
   c. Specifications for Structural Joints using ASTM A325 and A490 Bolts
3. ACI: 318, 336.3
5. AASHTO: M183

1.04 SUBMITTALS

A. Unless otherwise specified, the Contractor shall submit the information specified herein to the SEPTA Project Manager within 10 days of Notice to Proceed.

B. Submit details of proposed equipment, methods and sequence of operations to be used. Include as a minimum the following:
   1. Drilling rig dimensions, weights, heights and clearances.
   2. Equipment grounding plan.

C. Submit welding procedures and qualifications of welders and tackers as specified in AWS D1.1 for casing steel and AWS D12.1 for reinforcing steel.

D. Submit test reports and installation logs. Submit proposed installation log forms for acceptance.

E. Submit concrete mix designs with 7, 14 and 28 day break results.

F. Submit methods of securing and maintaining position of steel reinforcing.

G. Submit method of placing concrete.

H. Submit method and materials necessary to complete corrections for out-of-tolerance foundations.

I. Submit independent party test for slump and air entrainment.

J. Submit all independent party test results to the Project Manager.

K. Submit qualification of the Geotechnical Engineer.

PART 2 - EXECUTION

2.01 TOLERANCES

A. Variation of center of any drilled shaft foundation from the required plan location: Maximum 3 inches, measured at the ground surface in any horizontal direction.

B. Bottom diameter: Minus 0, plus 6 inches measured in any direction.

C. Maximum variation from vertical: 1:50.

D. Elevation of the top of shaft: Within 1 inch of cut-off elevation given on the Contract Drawings.
2.02 RECORD INFORMATION

A. For each foundation installed, record on installation logs the location, alignment, dimension, elevations of top and bottom, description of material encountered at all elevations, elevation of water table during excavation, condition of bottom of excavation, concrete data, verticality and deviation from plan location, and other data called for on the report form. Record the theoretical volume of excavation, volume of concrete placed vs. depth, and total volume of concrete placed. Report observed irregularities to the SEPTA Project Manager immediately after discovery.

B. Submit final record drawings of each foundation installed no more than 1 week after completion of the work.

2.03 CONCRETE

A. Catenary structure foundations shall be filled with "Portland Cement Concrete", concrete mix Class A (AE) with the following exceptions:

1. Minimum cement content: 564 lbs per cubic yard.
2. Sand Proportion: Great enough for proper flow of the concrete.
3. Rounded gravel aggregate or crushed stone: Maximum size ¾ inch.
4. Slump: 3 inches +/- 1.1.
5. Fly ash: 10 to 25 percent.
6. Air content: 6% +/- 1.5% when tested at the point of discharge from the truck.
7. Concrete shall be 4000 psi at 28 days with a minimum w/c ratio of 0.45.

2.04 REINFORCING STEEL

A. Deformed steel bar meeting the requirements of ASTM A615, Grade 60. Provide sizes of reinforcing steel as indicated on the Drawings.

2.05 ANCHOR BOLTS

A. Anchor rods shall be in accordance with ASTM F1554 Grade 36 and shall be fully hot dip galvanized in accordance with ASTM A123 and A153.

B. Anchor rods/cluster shall be plainly marked to indicate the structure number, type, etc. and shall be shipped with thread protectors.

C. Each anchor rod shall include two heavy hex nuts, washers, and a leveling nut. Heavy Hex Nuts shall conform to ASTM A563 Grade C3 or Grade DH galvanized.

D. Bolt assemblies shall be hot dip galvanized where shown on the drawings. Galvanizing shall conform to ASTM A123 and A153, and shall have a coating weight not less than 2.0 ounces per square foot.

E. Anchor rods shall be in accordance with the ACI-318, Building Code Requirements for Reinforced Concrete (latest edition) and Chapter 16 of SEPTA’s Structural Design Criteria and Guidelines.
2.06 CASING STEEL

A. Casing steel shall be welded ASTM A36, AASHTO M183, or A252. The thickness shall be as required to support soil and water pressure and withstand handling stress, but not less than 3/8 inch, unless noted otherwise on the Contract Drawings. Casing steel shall be left in place and removed above grade, if used as concrete formwork.

B. For vertical joints in non-corrugated permanent casings, provide full penetration welds which conform to AWS D1.1 requirements.

C. Alternative casing material may be submitted to SEPTA’s Project Manager for approval prior to use.

2.07 ANCHOR BOLT SETTING TEMPLATE

A. Template steel shall be welded ASTM A36. The thickness of the angles shall be as required to support the weight of the anchor bolts without deflection, but not less than 1/4 inch, unless noted otherwise on the Contract Drawings.

2.08 EMBEDDED STEEL COLUMNS

A. Embedded W section columns shall be welded ASTM A992. Embedded plate members shall be ASTM A36. Member size shall be as required to support applied loads due to guyng and withstand handling stress, but no beam element or plate shall be less than 3/8 inch thick, unless noted otherwise on the Contract Drawings.

B. Embedded columns and associated steel plate members shall be hot dipped galvanized after fabrication. Galvanizing shall conform to ASTM A123 and A143, and shall have a coating weight not less than 2.0 ounces per square foot.

C. Welding shall conform to AWS D1.1. Electrodes shall have a minimum tensile strength Fexx = 70 KSI. Welding electrodes shall be low hydrogen.

2.09 EXCAVATION EQUIPMENT

A. The drilling equipment shall have an auger shaft with helical blades and bits capable of advancing through soils and rock indicated on the nearest test borings shown on the Contract Plans, if available. The cutting edges of excavation equipment shall be normal to the vertical axis of the equipment within a tolerance of 3/8 inch plus and minus per foot of diameter. Completed foundation excavation shall have a planar bottom that is the perimeter of the auger shaft tip. Bottom of the foundation may slope uniformly towards the center of the shaft. The machine shall be equipped with inclination instrumentation to measure vertical alignment on two axes with an accuracy of not less than 1H:200V.

2.10 CONCRETE TESTING AND QUALITY CONTROL

A. General
   1. Furnish molds and concrete for all testing including testing performed by the testing agency. Provide tools necessary for making test specimens, slump tests, yield tests, and
shrinkage tests. Furnish labor and equipment for obtaining and handling all test samples.

2. Verify that batch tickets from ready-mix supplier properly describe the mix for the work being performed prior to permitting the discharge of concrete from the supplier’s truck.

3. Ensure that the ready-mix transport trucks are equipped with a drum revolution counter, and the drum turn rates are established prior to concrete placements.

B. Sampling and Testing Fresh Concrete: Fresh concrete used in the work shall be sampled and tested by the testing laboratory using technicians certified by the American Concrete Institute to determine its acceptability as required by ACI 318 and to demonstrate general conformance with specified properties as follows:

1. Sampling Fresh Concrete: ASTM C172

2. Slump: ASTM 0143; one test for each set of compressive strength test specimens, and one test for each concrete load at point of discharge.
   a. When superplasticizers are added at site, make slump tests from each concrete load before adding superplasticizer and after superplasticizer has been properly mixed into the fresh concrete.
   b. When liquid nitrogen is used to cool the concrete, make slump test before adding liquid nitrogen to the concrete mix.

3. Air Content: ASTM 0173, volumetric method for lightweight concrete; ASTM 0231 pressure method for normal weight concrete; one for each set of compressive strength specimens

4. Concrete Temperature: ASTM 01064; test concrete hourly when air temperature is 40°F and below, and when 90°F and above; and when each set of compression test specimens is made

5. Compressive Strength Specimens: ASTM C31; one set of four standard cylinders for each 100 cubic yards or fraction thereof, of each concrete type placed in any one day, or for each 5000 sq. ft. of surface area placed, or for each foundation poured, unless otherwise specified or directed. Mold and store cylinders for laboratory cured test specimens

6. Compressive Strength Test: ASTM C39; one specimen tested at 7 days, one at 14 days and one at 28 days, and one retained in reserve for later testing if required. When frequency of testing will provide less than five strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

7. Evaluation of Quality Control Tests: Subcontractor shall evaluate quality control tests. The test results shall be evaluated in accordance with the applicable provisions of ASTM C94. The Subcontractor shall adjust the mix proportions, increase the minimum cement content, and perform additional curing of structures or any combination of the above when specified strengths are not being met.

8. Shrinkage Tests: ASTM C157; one specimen tested at 7 days, one at 14 days and two at 28 days.
   a. Flexural Tests: ASTM 078; one specimen tested at 7 days, one at 14 days and two at 28 days.

C. Sampling and Testing Hardened Concrete

1. Make additional test of in-place concrete when test results indicate specified concrete strengths and other qualities have not been attained in the work. Conduct tests in accordance with ACI 318 and ASTM C42, or by other acceptable methods

D. Laboratory Reports

1. The approved testing laboratory shall be required to make written test reports that include the following information:
   a. Project name and structure
   b. Concrete placement date
2.11 EXCAVATION

A. General
1. Excavation shall be performed to the dimensions, depths, and tolerances indicated.
2. Excavate foundation holes by drilling, augering, or other effective methods to advance the excavation through overburden materials to the required bottom elevation. Use whatever means necessary to maintain a stable shaft without loss of ground.
3. Protect the excavation walls with steel cylinder casing to prevent instability or displacement of the surrounding earth, excessive water intrusion, or damage from construction operations.
4. Monitoring and evaluation of the shafts at each stage will be performed by the Engineer. Do not place concrete in the shaft until the shaft excavation has been accepted by the Engineer.
5. If an obstruction that is not shown on the plans is encountered, notify the Engineer immediately. Obstructions are defined as man-made or man-placed objects, man-made or man-placed materials, man-made or man-placed structures, or other man-placed materials encountered at or below ground surface which unavoidably and completely stop the progress of the shaft excavation or subsurface drilling work for more than one hour, despite the Contractor's diligent efforts, as determined by the Engineer. Bedrock shall not be treated as an obstruction during any drilled pier operations. The Contractor shall probe to locate the extent of the obstruction and propose a method of passing or removing it.
6. Obstructions shall not include any item whose penetration, demolition, removal, or excavation is included clearly and expressly in the Work of any other pay item. Drilling tools, which are lost in the excavation, shall not be considered obstructions and shall be promptly removed by the Contractor without compensation. All costs due to lost tool removal shall be borne by the Contractor including but not limited to, costs associated with the hole degradation due to removal operations or the time the hole remains open.

B. Rock Excavation
1. Where competent rock is encountered in the excavation prior to obtaining the desired foundation embedment (for either catenary pole foundations or down guy caissons), the Contractor shall drill and remove the rock as shown on the Contract Drawings.
2. Competent Rock is defined as rock that achieves a minimum of 25% RQD per the design. The Contractor's Geotechnical Engineer shall assess the quality of rock using judgment based on rock cores from the drilling operation or rock cuttings along with boring advancement rates. The Geotechnical Engineer may use other means to determine rock quality including exploratory subsurface investigation or video inspection.
3. As a guideline, competent bedrock will generally produce cuttings that are very strong. Competent rock produces sharp, angular, fresh, flaky diamond shape particles of fine gravel size without discoloration. Discharged water is almost clear. Conversely, weak and fissured rock strata produced semi angular, often elongated, rusty, and medium to course gravel with occasional cobbles in a matrix of fine/smashed particles. Traces of discolorations along fissure surfaces may be visible on the side(s) of rock pieces in the discharged samples. Discharged water will be of milky gray/brown color.

4. The Contractor’s Geotechnical Engineer shall submit the assessment of rock for each foundation to SEPTA. Competent rock shall be defined as rock retrieved with a minimum RQD of 25% in accordance with ASTM D6032 for the purposes of setting the bottom of the foundation in rock. The proposed shaft shall be terminated at the minimum tip elevation or 4ft into competent rock, whichever is shallower.

C. Groundwater Control

1. Prior to installation of ready mixed concrete, ground water shall not flow into the excavation rapidly enough to carry particles of soil or result in caving in of the excavation wall, bottom heaving, or ground settlement. Steel casings shall be driven to sufficient depth to cut-off ground water inflow.

2. If groundwater intrusion endangers the security of the excavation or adjacent property or structures, mitigative measures shall be implemented.

3. If dewatering of the foundations shafts is required, sediment carrying runoff may not be discharge into the track area until properly filtered through the use of filter bags or another approved method.

D. Inspection

1. Details of foundation construction shall be recorded on the catenary foundation installation logs.

2. If during the placement of concrete a sudden drop in level is detected; or if tremie placement by dumping is suspended for more than 2 hours; or if the theoretical volume deviates more than 10 percent from actual, the footing shall be cored to detect potential voids, unacceptable concrete, or other defects. The coring, and remedial actions necessitated by the results thereof, shall be performed in accordance with this specification and standard industry practices.

E. The Contractor shall be responsible for correcting foundations not constructed within the specified tolerances. Remedial measures, including engineering analysis and redesign, to correct for out-of-tolerance foundations, shall be performed at no additional cost to SEPTA.

F. Handling & Delivery

1. Access to the site may be limited or restricted and shall be coordinated through SEPTA and clearly detailed in the Site Specific Work Plan.

2. Deliver Anchor Bolts, Embedment Frame, and Anchor Bolt Template as soon as possible but no later than three weeks after approval of shop drawings.

3. Contractors shall be responsible for transport of the fabricated steel and delivery in accordance with industry standards, federal, state, and local regulations, and as specified herein.

4. Handle fabricated steel in a manner that will not overstress or damage the steel and coating. Nylon slings or other suitable devices shall be utilize to minimize damage to the coatings. The Contractor is responsible to repair all damaged steel and coatings to the satisfaction of SEPTA.

5. Materials may be staged on-site, space permitting, provided they are clear of the fouling envelope and secured, and with the approval from the SEPTA Project Manager and EIC/Flagman. All staging shall be coordinated through SEPTA and clearly detailed in the Site Specific Work Plan.
2.12 INSTALLATION OF CASING

A. Provide steel casing for shaft excavation where shown. The casing shall remain after the construction of the shaft. Excavations using permanent casing shall be made in a manner that the outside of the casing is in direct contact with undisturbed natural soils. Excavations for permanent casing shall have inside diameters equal to the nominal outside diameter of the shaft.

B. Permanent casing shall be continuously joined.

2.13 INSTALLATION OF REINFORCING STEEL

A. Where it is not practical to deliver the assembled reinforcing steel to the jobsite as a complete unit ready for installation, make splices on site prior to lowering the assembly into the hole. Provide splices only as shown on the Contract Drawings or approved shop drawings. Rebar cages shall be fully assembled and shipped within their respective caissons. Rebar cage assembly shall have the top two and bottom binder bars tack welded to the vertical bars to maintain the shape of the cage before shipping. The remainder of the assembly shall be tie wired at a minimum of two wraps per connection by a mechanized tie wire devise.

B. Prior to installation, inspect and clean reinforcing steel of materials that prevent effective bonding.

C. Place reinforcing steel in excavation hole immediately after cleaning the bottom as specified herein. Reinforcing steel shall be equipped with non-corrosive non-metallic centralizers to provide specified minimum concrete cover. Centralizers shall be spaced at intervals necessary to maintain specified cover, but in no case shall the spacing be greater than 10 feet. Dropping or forcing reinforcing steel into the shaft shall not be permitted. If the reinforcing steel does not properly or smoothly enter the excavation, it shall be retrieved and the excavation adjusted and properly cleaned as specified until the reinforcing fits smoothly. Repair or replace any damaged reinforcing.

D. After installation of reinforcing steel and immediately prior to concrete placement, the bottom of the excavation shall be measured to determine if sediment has accumulated on the bottom. If sediment is found to have accumulated on the bottom, clean the bottom of the excavation with an air-lift or other equipment which is capable of removing the sediment.

2.14 INSTALLATION OF ANCHOR BOTL SETTING TEMPLATE

A. Prior to installation, inspect and clean anchor bolt setting template. Place template on top of the temporary casing, such that the bottom of the steel angles rest on the rim of the temporary casing. Install anchor bolts in the template using the top leveling nuts to hold the anchor bolts above the top of the concrete at the heights specified in the Contract Drawings.

B. Once concrete has cured, remove top leveling nut and remove anchor bolt setting template. Replace the leveling nut.
2.15 PLACING CONCRETE

A. Prior to placing concrete, the Contractor shall coordinate with SEPTA to have the final location and elevation of the footings confirmed. Place concrete immediately after inspection by the SEPTA Project Manager of the completed excavation and placement of reinforcement. Shaft concrete shall be placed within 24 hours of completion of footing excavation.

B. Place concrete in one continuous operation. If a construction joint is unavoidable, level, roughen, and clean the surface before recommencing concrete placement. Concrete shall be placed through a tremie or concrete pump, if required. In accordance with the Standard Specifications.

C. Vibrate the top 5 feet of concrete where casing is permanent.

D. Fill void space between permanent casing and shaft excavation with concrete or fluid grout.

E. Cure and finish the top of the shaft to comply with the Contract Drawings and with the construction methods of the State Standard Specifications.

2.16 ACCEPTANCE AND REJECTION OF FOOTING

A. Core-holes shall be drilled into catenary structure foundations of questionable quality. When a defect is confirmed by coring of the concrete, the Contractor is responsible for the cost of coring and subsequent grouting of the hole. However, if no defects are found, SEPTA will pay for all coring costs, including pressure grouting of the core-holes. The SEPTA Project Manager will be the sole judge of catenary foundation.

B. In the case that a footing is determined to be unacceptable, the Contractor shall submit a plan for remedial action to the SEPTA Project Manager. Calculations and working drawings for the remedial action shall be stamped by a Registered Professional Civil Engineer in the State of Pennsylvania. Labor and materials necessary to perform the remediation shall be furnished without cost to SEPTA and without an extension of the contract time.

2.17 OBSTRUCTION REMOVAL

A. Comply with all obstruction removal requirements as shown on the Contract Drawings, this specification, directed by the SEPTA Project Manager, or elected by the Contractor.

END OF SECTION 16384