# COMPUTER AIDED RADIO DISPATCH SYSTEM PROJECT

## SEPTA PROJECT 20-00554-ATMM

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SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The work described herein consists of all work necessary for the provisioning, design, development, fabrication, construction, testing, training, documentation, installation, and commissioning of the SEPTA Computer-Aided Radio Dispatch (CARD) Replacement System, or SEPTA CARD Replacement System.

B. The SEPTA CARD Replacement System shall hereafter be referred to in these documents as the CARD System. The following summary of work is not necessarily complete and is not presented in the order in which the work shall be performed. A detailed description of the work required under this Project is contained within the appropriate Specification Sections and/or Contract Drawings.

C. The Southeastern Pennsylvania Transportation Authority, known as SEPTA, is the major transit provider operating bus, commuter rail, rapid transit, light rail, and electric trolleybus services for Philadelphia and the counties of Delaware, Montgomery, Bucks and Chester. It is a state-created authority, with the majority of its board appointed by the five Pennsylvania counties it serves. SEPTA is the 6th-largest U.S. rapid transit system by ridership, and the 5th largest overall transit system, with about 306.9 million annual unlinked trips.

1. SEPTA’s bus service utilizes a fleet of approximately 1,617 revenue vehicles operating on 121 routes, not including over 50 school trips, with most routes in the City of Philadelphia proper. SEPTA generally employs lettered, one and two-digit route numbering for its City Division routes, 90-series and 100-series routes for its Victory Division (Chester, Delaware and Montgomery Counties) and its Frontier Division (Montgomery and Bucks Counties), 200-series routes for its Regional Rail connector routes (Routes 201, 204, 205 and 206 in Montgomery & Chester Counties), 300-series routes for other specialized or third-party contract routes and 400-series routes for limited service buses to schools within Philadelphia. CAD/AVL system and radios currently in use on the SEPTA buses shall be replaced as part of this project. The specific types and quantities are defined in the Contract Drawings.

2. SEPTA’s rapid transit lines include:
   a. Market–Frankford Line (Blue Line or El): subway and elevated line from the Frankford Transportation Center (rebuilt in 2003) in the Frankford section of Philadelphia to 69th Street Transportation Center in Upper Darby, via Center City Philadelphia. Weekday ridership averaged 191,716 in 2018. Radios currently in use on the Market-Frankford Line shall be replaced as part of this project. The specific types and quantities are defined in the Contract Drawings.
b. Broad Street Line and Broad–Ridge Spur (Orange Line): subway line along Broad Street in Philadelphia from Fern Rock Transportation Center to NRG Station/Sports Complex (formerly Pattison Station and AT&T Station), via Center City Philadelphia. Weekday ridership averaged 139,950 in 2018. Radios currently in use on the Broad Street Line shall be replaced as part of this project. The specific types and quantities are defined in the Contract Drawings.

3. SEPTA also operates approximately 177 trolleys and an interurban rail line with an additional 26 trains. CAD/AVL system and radios currently in use on the SEPTA trolleys and interurban rail line shall be replaced as part of this project. The specific types and quantities are defined in the Contract Drawings.

4. SEPTA also oversees shared-ride services in Philadelphia and ADA services across the region through its Customized Community Transportation (CCT) service, which includes 458 vehicles and is operated by third-party contractors. SEPTA's headquarters is located at 1234 Market Street in Center City, Philadelphia. CAD/AVL system and radios currently in use on the CCT vehicles shall be replaced as part of this project. The specific types and quantities are defined in the Contract Drawings.

D. The SEPTA CARD System shall include a Computer-Aided Radio Dispatch (CARD) System consisting of a 700 MHz radio system, a Computer-Aided Dispatch/Automatic Vehicle Location (CAD/AVL) System, transit vehicle equipment supporting the 700 MHz radio, CAD/AVL functionality, and related CARD System services and support. The CARD System shall support SEPTA’s fixed-route revenue buses, trackless trolleys, trolleys (City and Suburban), and the Norristown High Speed Line at nine (9) depots and operating throughout SEPTA’s entire greater Philadelphia metropolitan service area. The CAD/AVL system shall also support the Customized Community Transportation (CCT), which provides paratransit service known as CCT Connect to individuals with disabilities and senior citizens. The specific types and quantities of vehicles to be equipped with CARD System equipment are defined in the Contract Drawings.

E. The new CARD System shall be distributed among a primary and backup control center for user workstations as well as separate primary and backup server sites as follows:

a. Primary Control Center: The existing control center at 1234 Market Street in Philadelphia will remain the primary user site where the Contractor shall install primary user equipment.

b. Ancillary Control Center: The backup user equipment shall be located at the existing Ancillary Control Center (ACC) at the Frankford Transportation Center.

c. Primary Server Room: The primary servers shall be located at 1234 Market Street in Philadelphia.

d. Backup Server Room: The backup servers shall be located at the existing Radio server room at SEPTA’s facility located at 2nd Street and Wyoming
Avenue in Philadelphia.

F. Buses and Trollies are currently operated in all parts of SEPTA service area from ten (10) depots listed below:

<table>
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<td>Bus Depot</td>
<td><strong>Allegheny depot.</strong> 2601 Allegheny Av between 26th &amp; 27th Streets; Tioga</td>
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<tr>
<td>Bus and Light Rail Depot</td>
<td><strong>Callowhill depot.</strong> Callowhill St between 58th &amp; 59th Streets; West Philadelphia</td>
</tr>
<tr>
<td>Bus Depot</td>
<td><strong>Comly depot.</strong> Comly St &amp; Bustleton Av; Oxford Circle</td>
</tr>
<tr>
<td>Light Rail Only Depot</td>
<td><strong>Elmwood depot.</strong> Island &amp; Elmwood Avenues; Southwest Philadelphia</td>
</tr>
<tr>
<td>Bus Depot</td>
<td><strong>Frankford depot.</strong> Frankford Av between Bridge &amp; Pratt St Frankford Terminal; Frankford</td>
</tr>
<tr>
<td>Bus Depot</td>
<td><strong>Frontier depot.</strong> Alan Wood Rd, north of Ridge Pike, Plymouth Twp, Montgomery County</td>
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<tr>
<td>Bus Depot</td>
<td><strong>Germantown depot.</strong> 6725 Germantown Ave, Philadelphia, PA 19119</td>
</tr>
<tr>
<td>Bus Depot</td>
<td><strong>Midvale depot.</strong> 4401 Wissahickon Ave; Nicetown -Tioga</td>
</tr>
<tr>
<td>Bus Depot</td>
<td><strong>Southern depot.</strong> Johnston St between 19th &amp; 20th St.</td>
</tr>
<tr>
<td>Bus and Light Rail Depot</td>
<td><strong>Victory depot.</strong> Victory Ave, Upper Darby Twp, Delaware County</td>
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G. The SEPTA CARD System shall include a Network Fault Management System (NMS) for the 700 MHz radio system, a Network Fault Management System (NMS) for the Microwave system, a Network Management System for Computer-Aided Dispatch/Automatic Vehicle Location (CAD/AVL) System and a Central Network Management System managing all CARD devices. Additional detail can be found in Division 16, section 16750 and shown in the Contract Drawings.

H. The SEPTA CARD System shall include a Network Security System for the 700 MHz radio system, Network Security System for the Microwave system, a Network Security System for Computer-Aided Dispatch/Automatic Vehicle Location (CAD/AVL) System and a central Network Security System managing all CARD devices. Additional detail can be found in Division 16, section 16770.
I. The SEPTA CARD System shall include all support services specified herein, including project management, periodic project meetings, formal preliminary and final design reviews, factory and field testing, installation, training, documentation, spare parts and warranty.

J. The SEPTA CARD System shall be designed to meet all defined system requirements and to be expandable to support future functional requirements for the minimum system design life of 15 years.

K. Work described under this Section shall be performed in accordance with the Contract, Special Conditions, and Technical Provisions of these Contract Documents, and references contained therein.

L. The Contractor shall furnish all labor, material, equipment, supervision, transportation, and miscellaneous services, whether or not explicitly identified herein, to provide a completely tested and fully operational SEPTA CARD System, including all work at the control center and any ancillary systems.

M. The Contract Drawings are conceptual design drawings and are not intended for construction. The Contractor shall be solely responsible for developing the final design based on the contract requirements.

N. In this Specification all references to "number of days" shall mean calendar days unless otherwise stated. References to "major systems" shall mean those products which are generically described by the title of any Section of this Technical Specification, and references to "major suppliers" shall mean the suppliers of these major systems.

O. As used throughout this Contract the words design, furnish, provide, wire, upgrade, modify, install, program, test, commission, certify, or other words meant to convey the Contractor’s work on this project shall mean design, furnish, install and test to an operational and reliable state of all systems and sub-systems required for SEPTA CARD System to function as required by this Contract.

1.02 CAD/AVL SYSTEM WORK

A. The CAD/AVL System portion of the SEPTA CARD System shall consist of a turnkey, fully-integrated and functional system including, but not be limited to, all central system hardware, software and interfaces to external systems, including equipment supporting system users at the Primary and Ancillary Control Centers.

B. CAD/AVL System vehicle equipment shall replace existing Orbital/Conduent on-board intelligent vehicle processors, operator display devices, and vehicle location equipment. The CAD/AVL System shall interface to existing Vehicle Logic Unit Controllers (DR 500C+, 600, 700, or IVN supplied by Clever Devices) and existing fareboxes for the purpose of sending login information only. Other on-board devices including audio announcement and visual display signs and the Clever Devices BusTime® Real Time Passenger Information System, Automatic Vehicle Monitoring (AVM) systems, and discrete inputs are NOT included in the CARD System and shall continue to be monitored and controlled by the existing Vehicle Logic Controller supplied by Clever Devices. The 700 MHz radio system shall be used for voice communications. SEPTA’s existing 4G LTE cellular communications shall be used for all data communications with the vehicle fleet. The CAD/AVL system shall support...
transfer from bulk, non-real-time data at depots through cellular or Wireless LAN if available.

C. The SEPTA CARD System shall support the industry standard data formats and interface protocols, including General Transit Feed Specification (GTFS) Real Time, specified herein.

1.03 RADIO COMMUNICATIONS WORK

A. The Contractor shall supply the 700 MHz radio system portion of the CARD System that shall utilize the recent acquisition of eighteen channels approved from the FCC and will replace the current T-Band spectrum. The Contractor shall attempt to use the existing communication sites in service to the maximum extent possible with the addition of new locations to supplement coverage that meet the requirements of the coverage specification. The radio system shall be designed with both P25 Phase II Trunking having two slots per channel (two talk paths) and P25 Digital Conventional channels. The Contractor shall configure the system based on the user groups along with the required service area defined by SEPTA. SEPTA Police will utilize the City Public Safety 800 MHz system when in the Philadelphia City limits and then roam onto the SEPTA 700 MHz system when outside that area. The radio sites shall be interconnected via a licensed microwave system using the 6 and 11 GHz frequency bands and SEPTA owned Fiber SONET network (where available). The microwave system shall be redundant with either a hot standby or loop configuration. Dispatch radio consoles at the primary and ancillary centers shall be replaced to support the voice communication. Underground areas shall be serviced using the DCS BDA system with the SEPTA 700 MHz channels interfacing to the existing 15th Street and Fairmount head-end locations. Additional detail on the sub-systems that make up the 700 MHz radio design can be found in Division 13.

1.04 CONTROL CENTER AND SERVER ROOM WORK

A. Control Centers: The Contractor shall furnish all labor and material necessary to supply and install user equipment including workstations, monitors, and printers in the existing control center console furniture as well as all network equipment and wiring including network switches, routers, and firewalls at both the Primary and Ancillary Control Center (ACC) sites.

B. Server Rooms: The Contractor shall furnish all labor and material necessary to supply and install all equipment and racks in both the Primary and Backup Server Rooms.

a. The Primary Server Room shall be located at the SEPTA facility at 1234 Market St in Philadelphia, PA, as shown in the Contract Drawings.

b. The Backup Server Room shall be located at the SEPTA facility at 2nd Street & Wyoming Avenue in Philadelphia, PA, as shown in the Contract Drawings

C. Refer to Specification Section 13582, “Control Center Equipment and Modifications” for additional information.

1.05 SEQUENCE OF INSTALLATION AND COMMISSIONING

A. The current CAD/AVL system has exceeded the system design lifespan and its replacement shall not be delayed by the radio system replacement. While SEPTA
wants the CAD/AVL system replaced as soon as possible, installing CARD equipment on revenue vehicles has a significant impact on SEPTA bus operations and shall be limited to a single installation for both CAD/AVL and Radio equipment. Therefore, in order to avoid the need to take revenue vehicles out of service once for CAD/AVL equipment installation and a second time to install the radio equipment, SEPTA has specified multiband mobile radios for revenue vehicles. The installation of mobile radios shall be done concurrently with the installation of CAD/AVL equipment on revenue vehicles listed in the Contract Drawings. The Multi-Band 700/800 MHz and UHF Range 2 (450-512 MHz) P25 Mobile Radio shall be installed to accommodate the existing T-Band spectrum radio currently operating on SEPTA vehicles as well as the new 700 MHz system. As part of the Revenue vehicle radio installations, the Contractor shall build in the capability to remotely configure and update the mobile radio over a Contractor-supplied wireless connection without the need to revisit every vehicle.

B. Implementation of the SEPTA CARD System shall be performed in accordance with detailed schedule requirements included in Section 01300 and the milestone dates described below and shall support a smooth transition between SEPTA’s existing CARD System and the replacement CARD System. As such, an extended period of parallel concurrent operations will be required during which both the existing CARD System and the replacement CARD System shall be operational. Existing CARD System equipment, software and interfaces shall remain installed and operational until no longer required to support operations.

C. The major milestone dates for installation and commissioning of the CAD/AVL system shall be as follows:

   a. The Preliminary Design Review (PDR) shall be conducted no later than 200 calendar days after NTP.

   b. The Final Design Review (FDR) shall be conducted no later than 300 calendar days after NTP.

   c. The Factory Acceptance Test (FAT) shall be successfully completed no later than 365 calendar days after NTP.

   d. System Installation Test (SIT) shall be successfully completed no later than 425 calendar days after NTP.

   e. Vehicle System installation shall be completed no later than 790 calendar days after NTP.

   f. The System Acceptance Test (SAT) shall be successfully completed and the start of warranty shall commence on later than 820 calendar days after NTP.

D. The major milestone dates for installation and commissioning of the 700 MHz radio system shall be as follows:

   a. The Final Design Review (FDR) shall be conducted no later than 365 calendar days after NTP.

   b. The Factory Acceptance Test (FAT) shall be successfully completed no later than 575 calendar days after NTP.
c. The Site Acceptance Test shall be successfully completed no later than 720 calendar days after NTP.

d. The Coverage Acceptance Test shall be successfully completed no later than 1095 calendar days after NTP.

e. The Final Acceptance Certificate shall be issued no later than 1460 calendar days after NTP.

1.06 EQUIPMENT AND MATERIALS

A. Where items of equipment and/or material is defined by using a trade name or the name and catalog number of a particular manufacturer or vendor, or a limited description, the term "OR EQUAL" if not written thereafter shall be implied. Any reference to a particular manufacturer's product either by trade name or limited description is only for purposes of setting a standard of performance, quality, composition, construction, operation or size.

B. The term "OR EQUAL" means any other manufactured product or article which is equivalent in material, workmanship and service and is as efficient and economical in operation in the opinion of SEPTA.

C. Certain aspects of the work cannot be substituted by the Contractor. This is to include:
   a. Wide Area Network (WAN) switches supplied by Extreme Networks.
   b. Firewalls supplied by Barracuda.

D. Contractor requirements for submission of substituted materials and equipment are defined within Section 01600, "Materials and Equipment".

1.07 RELATED SECTIONS

A. All Specifications Sections and Contract Drawings.

1.08 CONTRACTOR’S GENERAL OBLIGATIONS

A. The Contractor shall assume responsibility for the design, engineering, documentation fabrication, procurement, software implementation, testing, training, delivery, project schedule, installation, start-up, and warranty of all subsystems and components of the CARD System, interfaces to existing SEPTA systems, communications equipment, and field interface equipment specified herein. The Contractor’s obligations shall include, but not be limited to, the responsibilities in the following list and those required to meet the requirements described in this Specification:

   a. System engineering, design, analysis, programming, and installation.

   b. All hardware required to satisfy the requirements of this Specification.

   c. All software required to satisfy the requirements of this Specification, including operating system, database, communication, and application software.

   d. Project Management, including project scheduling, periodic project meetings,
conference calls, and periodic project reports documenting progress during the contract period.

e. The contractor is required to submit all information through the SEPTA PMIS.

f. Providing SEPTA with final design details for actual equipment being supplied under this Contract, including LAN, WANs and other interface related items and shall include all information required for coordination between subcontractors.

g. Providing SEPTA with any information needed by SEPTA.

h. Develop a field implementation plan, covering installation, test, start-up, and cutover from the existing CARD System to the new CARD Replacement System. The plan shall address a phased implementation approach whereby vehicles in the fleet are phased over to the CARD System, tested and successfully tested on-line for a period of time, as approved by SEPTA, before additional vehicles are phased over to the new CARD Replacement System. The field implementation plan shall allow for a smooth migration from the existing CARD System to the new CARD Replacement System with minimum disruption to SEPTA's revenue operations.

i. Provide all processors, console workstations, all user interface and other peripheral equipment, data and power cabling, related hardware and interconnection of all equipment at the Primary Control Center, Ancillary Control Center (ACC), Primary and Backup Server Rooms, and the communications and field interface equipment located at communications sites, garages, and vehicles.

j. Communications interface hardware and software for interfacing between all Radio and CAD/AVL equipment.

k. Provide all hardware and software necessary to convert from the existing CARD System to the new CARD Replacement System.

l. Integration of all Contractor-provided hardware and software into a complete functioning system.

m. Power distribution within enclosures at all facilities.

n. Factory Acceptance Testing (FAT) of all functional capabilities of the Contractor-provided hardware and software. All equipment and tests shall be fully staged in the final field configurations for the FAT execution.

o. Shipment and delivery of all Contractor-provided equipment.

p. Startup and field testing of all Contractor-provided equipment and functions, including communications interfaces, at SEPTA facilities – including facilities leased by SEPTA.

q. Provide the hardware and software necessary to operate the CARD System and all its components and functions.

r. System performance verification and acceptance testing.
s. Support CARD System availability testing at SEPTA’s facilities - including facilities leased by SEPTA.

t. Complete documentation covering all hardware, firmware, and software.

u. Hardware, firmware, and software maintenance of the CARD system, communications equipment and field equipment through field acceptance by SEPTA.

v. Hardware and software maintenance support and spare parts through the warranty period.

w. Training of SEPTA’s maintenance, operating, and supervisory personnel.

x. Technical assistance to SEPTA during the contract.

y. Availability of service, spare parts, and expansion parts for all CARD equipment for a 15-year period from the date of final acceptance.

z. Special test equipment and software required to troubleshoot and maintain all CARD System equipment.

aa. Compliance with all laws, ordinances, rules and regulations of SEPTA and government authorities having jurisdiction over the project.

B. Detailed descriptions of the Contractor’s obligations in relation to particular items of hardware, software, functional requirements, and services are contained in other sections of this Specification.

1.09 CONTRACTOR’S PERSONNEL RESPONSIBILITIES

A. The Contractor shall assign a Project Team to the Project for its duration. The Project Team shall include at least five key staff members (Project Manager, Systems Software/Integration Engineer, Radio Engineer, Vehicle Engineer, and a Communications / Control Center Hardware Engineer.)

B. Resumes of all key staff members shall be submitted for approval by SEPTA. Once approved by SEPTA, key staff personnel (Project Manager, Systems Software/Integration Engineer, Radio Engineer, Vehicle Engineer, and a Communications / Control Center Hardware Engineer) shall be assigned to this project for the duration of the design and construction phases of the work and shall not be removed from this Project without the written approval of SEPTA.

C. Key staff personnel shall have previous experience in a similar position on at least three other projects similar in scope and magnitude to this project.

D. The Contractor shall also submit a listing and organization chart of other Contractor and Sub-contractor personnel required to support the key personnel. Responsibilities for this Contract and the percentage of time to be allocated to this Contract shall be listed for each project team member

E. Contractor’s Project Manager:

1. The Contractor shall designate a full-time employee of their staff to act as the
Contractor's Project Manager. The Contractor's Project Manager shall have a minimum of 10 years’ experience in the management, administration and supervision of large and complex Communications engineering and construction projects. The Project Manager shall also be experienced in the management and direction of sub-Contractors and their work. The Contractor's Project Manager shall have the authority to make contractual commitments and decisions that are binding on the Contractor.

2. The Project Manager may also provide the duties of the Safety Officer and Quality Control Representative for the Project. This shall include all quality assurance and Project related safety plans and tasks. Project safety personnel shall report directly to the Project Manager. The Project Manager shall have the authority to direct removal and replacement of any defective work. The Project Manager shall report all on-the-job injuries at once to the SEPTA Project Manager and submit all paperwork pertaining to such injuries, as required.

1.10 SEPTA PARTICIPATION

A. In addition to providing information required by the Contractor, SEPTA will review and approve design and test documents, closely monitor progress and schedule, and participate in FAT and field testing.

B. SEPTA will supply the following items and services as part of the CARD Replacement System project implementation:

   a. Power sources at the Primary Control Center, ACC, and all field locations where equipment is to be installed by the Contractor. The Contractor shall supply power distribution etc., at all sites, garages and equipment locations.

   b. Coordination of Contractor's activities with SEPTA's operating requirements.

   c. Participation and review in the development of a field implementation plan, covering installation, test, startup, and cut over from the existing CARD System to the new CARD Replacement System.

PART 2 – PRODUCTS - NOT APPLICABLE

PART 3 – EXECUTION - NOT APPLICABLE

END OF SECTION
SECTION 01025
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies the general requirements for measurement of quantities and the provisions for payment of the Contract in addition to the requirements and provisions set forth in this Contract.

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

C. The Contractor shall submit a Value Line Breakdown in tabular form, identifying each value line description, unit of measure, quantity and total cost to SEPTA’s Project Manager for approval. The Value Line Breakdown shall be in compliance with all provisions of Exhibit III of the Agreement.

1.02 RELATED WORK

A. Exhibit III of the Agreement.

B. Article XII, “Payment and Completion” of the Agreement and all other payment provisions within the Agreement.

1.03 MEASUREMENT OF QUANTITIES

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

1.04 SCOPE OF PAYMENT

A. Payment shall be made at the Contract Lump Sum Price in accordance with the provisions of this Contract and shall constitute full compensation for the provision of complete usable items.

B. Payment shall not be made until the SEPTA Project Manager or his representative has inspected and approved the work for payment. All cost for work to be performed shall be covered by the Lump Sum prices indicated on the Schedule of Base Bid Items.

C. Where work described in the Specifications is not directly indicated to be covered by a specific price item, the costs in connection with such work shall be included in the prices bid for the appropriate items in the Schedule of Items and Prices Bid, Schedule A of the Agreement.

D. Deviation in the actual quantities either above or below the estimated quantities shown in the Contract Documents shall not be made a basis for a claim or adjustment in any of the Contract prices. Work paid under one item shall not be paid for under any other item.
E. All payments shall be made in accordance with the conditions listed in Exhibit III of the Agreement.

1.05 QUALITY ASSURANCE

A. The Work of this Section shall be in accordance with Section 01400, “Quality Control and Warranty Requirements”.

1.06 SCHEDULE OF PAYMENTS

A. The Contractor shall supply unit prices for items identified in the Schedule of Items and Prices Bid, Schedule A of the Agreement.

1.07 SCHEDULE OF ITEMS BREAKDOWN

A. In addition to the requirements of this Contract, the payment items in the Schedule of Items and Prices Bid, Schedule A of the Agreement, shall be governed by the following:

1. Mobilization, Facilities, Administration, and Project Documentation
   a. This work consists of the mobilization of the construction plant and field office and equipment at the work site; for materials and supplies necessary for the prosecution of the Work, but not to be incorporated in the Work; for construction of temporary facilities; for personal services hired for work preparatory to commencing the Work and for demobilization of the construction plant and field office.
   b. Any work which consists of project administration and creation of required documentation.
   c. Payment to be made at the Contract Lump Sum Price Bid as indicated on the Schedule of Items and Prices Bid, Schedule A of the Agreement, complete as specified.

2. Communications, Control Center, and Systems Design
   a. This work consists of all design for all locations at Preliminary and Final design levels. This is to include all labor, materials and expenses for design review meetings and attendance.
   b. Payment to be made at the Contract Lump Sum Price Bid for Communications, Control Center, and Systems Design as indicated on the Schedule of Items and Prices Bid, Schedule A of the Agreement, complete as specified.

3. Demonstration of Integration Testing and Software Validation
   a. This work consists of the Factory, and Final Site Acceptance Testing and the demonstration of Integration Testing and Software Validation required for the implementation of a fully functional SEPTA CARD System.
b. Payment to be made at the Contract Lump Sum Price Bid for demonstration of Integration Testing and Software Validation as indicated on the Schedule of Items and Prices Bid, Schedule A of the Agreement, complete as specified.

4. Control Center Systems

a. This work consists of furnishing, installing, and the operational testing of complete CARD Systems elements, components, networks, and ancillary devices that are required to supply a complete and comprehensive SEPTA CARD Primary and Back-up Control Center Systems.

b. Payment to be made at the Contract Lump Sum Price Bid for Control Center Systems as indicated on the Schedule of Items and Prices Bid, Schedule A of the Agreement, complete as specified.

5. Warranty

a. This work consists of provisioning of all Warranties as described by these Specifications and as required within the Agreement.

b. Payment to be made at the Contract Lump Sum Price Bid for Warranty as indicated on the Schedule of Items and Prices Bid, Schedule A of the Agreement, complete as specified.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION – NOT APPLICABLE

END OF SECTION
SECTION 01041
PROJECT COORDINATION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK A. General

1. The work of this Project requires close coordination of Sub-Contractors and SEPTA for a successful deployment of the SEPTA CARD System.

B. Management of Work

1. The Contractor’s Project Manager shall execute and take responsibility for:

   a. The overall progress of the project
   b. Reporting of all project activities to SEPTA
   c. Meeting of schedule milestones and deliverables
   d. Ensuring high quality of tangible and written output
   e. Meeting the contractual obligations of the project in relation to reporting and financial matters
   f. Overall planning of the project
   g. Coordinating and overseeing all work of the Sub-Contractors
   h. Organization, chairmanship and reporting of progress meetings and technical meetings
   i. Maximizing the dissemination activities of the project required to optimize its impact
   j. Resolving any conflict that arises in the project, through discussions with the relevant parties and reference to the specification where necessary
   k. Overall safety including related plans and tasks
   l. Quality assurance and authority to direct the removal and replacement of defective work

2. Responsibility for achieving the objectives of the work in the project shall be shared between the project partners. The role of the Systems Integration Engineer shall be to:

   a. Plan and organize the work required
   b. Coordination and integration of all details among the various disciplines
c. Ensure the work is progressing at the rate required to achieve the milestones and deliverables envisaged.

d. Ensure good communication between partners

e. Monitor the quality of field work

f. Carry out technical work as designed

g. Provide written reports to the SEPTA Project Manager as required

3. Further requirements for the management of the work are as defined within Section 01010 “Summary of Work”.

C. Systems Coordination

1. General

a. The Contractor shall be responsible for all facets of the entire CARD system and all of its equipment. The Contractor shall be responsible to SEPTA for proper operation, reliability, safety, functionality, and system integration of all phases of the CARD system.

1.02 SUBCONTRACTOR WORK

A. The Contractor must, before making any Sub-Contract, submit a written statement to the SEPTA Project Manager for approval to execute the contract. If SEPTA determines that the proposed Sub-Contractor is acceptable, the Contractor will be notified in writing. SEPTA may revoke approval of any Sub-Contractor when such Sub-Contractor evidences an unwillingness or inability to perform his work in strict accordance with the Contract Documents, and at any time during the duration of the project. Notice of such revocation of approval will be given in writing to the Contractor.

B. The Contractor shall promptly, upon request, file with SEPTA a conformed copy of the Sub-Contract. The Contractor shall cause appropriate provisions to be inserted in all Sub-Contracts relative to the work to bind Sub-Contractors to the Contract by the terms of these Contract Documents, insofar as applicable to the work of Sub-Contractors, and to give the Contractor the same power as regards terminating any Sub-Contract that SEPTA may exercise over the Contractor under provisions of these Contract Documents.

C. The approval by SEPTA of a Sub-Contractor shall not relieve the Contractor of any of his responsibilities, duties and liabilities. The Contractor shall be solely responsible to SEPTA for the acts or defaults or omissions of his Sub-Contractor and of such Sub-Contractor's officers, agents, and or employees of the Sub-Contractor. Nothing contained in the Contract Documents shall create any contractual relationship between any Sub-Contractor and SEPTA.

D. The Contractor shall organize, establish, maintain, control, and justify all subcontractors performing activities or supplying products within these Contract documents.
E. The Contractor’s Project Manager shall be responsible for communications to and from Sub-Contractors, and timely delivery of all Sub-Contractor provided products, information and work.

1.03 MANAGING KEY INFORMATION

A. The Contractor shall incorporate software programs to increase efficiency, such as to maintain project files and manage key information.

B. The Contractor shall make sure that project information remains easily accessible to key participants.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION – NOT APPLICABLE

END OF SECTION
SECTION 01060
REGULATORY REQUIREMENTS AND SAFETY

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

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

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

1.02 RELATED WORK

A. Section 01041 “Project Coordination”

B. Section 01400 “Quality Control and Warranty Requirements”

1.03 QUALITY ASSURANCE

A. The Contractor shall monitor and document his compliance and performance of the requirements set forth in this Section on a daily basis. This process shall be consistent with appropriate SEPTA work rules, as well as Local, Commonwealth, and Federal rules and regulations.

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

1. Construction Orientation
2. OSHA Inspection and Compliance
3. General and Site Specific Safety
4. Workmen’s Compensation Reporting
5. Fall Protection/Personal Protective Equipment (including work shoes)
6. Confined Space
7. Hazardous Materials
8. Trenching and Excavation
9. Cranes
10. Electrical Protection
11. Drug and Alcohol
12. Public and Passenger Protection
C. If approved by the SEPTA Project Manager, the Contractor’s Project Manager may also assume the duties of the Safety Officer and Quality Control Representative and shall be responsible for all quality assurance and safety-related activities until the completion of the Work in the Contract documents for all contract employees working on this project. Project safety personnel shall report directly to the Project Manager. The Project Manager shall report all on-the-job injuries at once to the SEPTA Project Manager and submit all paperwork pertaining to such injuries, as required.

D. The Contractor’s safety personnel shall as a minimum hold weekly (tool box) safety meetings with all of the Contractors personal. Subjects, time, and location will be set at the Contractor’s convenience. SEPTA requires at least three (3) days prior notice of location and time of each meeting, and an agenda shall be submitted to the SEPTA Project Manager. Minutes of each safety meeting shall be provided to the SEPTA Project Manager at each regularly-scheduled project coordination meeting.

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

1.04 GENERAL SAFETY REQUIREMENTS

A. All work shall be performed in accordance with rules, regulations, procedures, and safe practices of SEPTA,), the Commonwealth of Pennsylvania, Occupational Safety and Health Administration (OSHA), and all other government agencies having jurisdiction over the work. The following safety rules are identified from the aforementioned documents and are considered especially applicable to all of the contractors’ employees in regard to conduct while on SEPTA property.

1. Contractor’s employees shall wear hardhats, suitable work shoes or boots, vests, and full body clothing, at all times, and safety glasses when required.

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

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

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

5. The safety vest shall be ANSI 107, Class 2 high visibility with yellow-green background and 2-inch retro reflective striping.
6. The contractor’s personnel shall wear long pants (without cuffs) and, at a minimum, short sleeve shirts.

1.05 PROTECTION OF THE PUBLIC

A. The Contractor shall take all necessary precautions to prevent injury to the public and damage to property of others. If required, before commencing operations, the Contractor shall furnish and erect construction fencing or barricades as specified for the safeguarding of the public against accident or damage resulting from the Contractor’s operations, and as required to prevent unauthorized access to the Work or to the storage areas. The Contractor shall maintain the construction fencing until removal. The Contractor shall dismantle and remove construction fencing when required or when directed by the SEPTA Project Manager.

1.06 EMERGENCY PROCEDURES

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

1. Fire
2. Injury to employees
3. Injury to general public
4. Property damage, including property of utilities, i.e., gas, water, sewage, electrical, telephone or pedestrian and vehicle routes
5. Hazardous/toxic material spill discharges
6. Property damage in control center or vehicles
7. Site evacuation

B. Copies of all guidelines for emergency procedures shall be written and posted prior to the initiation of actual work. Posting shall include directions to and from the nearest hospital. These guidelines shall be included in the Contractor's written safety program and shall be submitted to SEPTA.

1.07 PROTECTION OF SEPTA FACILITIES

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

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

1.08 STORAGE AND HANDLING OF MATERIALS

A. The Contractor shall store equipment and materials at the jobsite in accordance with
instructions of the SEPTA Project Manager and in conformance with applicable regulatory provisions. The Contractor shall not store unnecessary items at the jobsite. Flammable materials shall not be stored in confined spaces such as tunnels. Safety containers meeting all current codes and standards shall be used for the storage of all flammables.

B. The Contractor shall take care to prevent any structure from being loaded with a weight which will endanger its security or the safety of persons. The Contractor shall enforce the instructions of the SEPTA Project Manager regarding such items as signs, fires, and smoking.

C. The Contractor must submit for review by the SEPTA Project Manager, sketches defining the operations of all cranes or booms used in support of construction during periods of train operations. The Contractor must submit, at the SEPTA Project Manager's request, similar information for cranes or other equipment in use and capable of encroachment. This submittal must be made as part of the Contractor's work plan, 30 calendar days prior to the operation.

1. These sketches must include planned locations and movements of the equipment, calculations demonstrating the adequacy of the capacity of the crane for the loads, the interface between the footprint of the equipment the movement of the boom and loads relative to the existing structure and surrounding buildings, the support grillages and the protection of existing utilities and facilities, and any other pertinent details required by the SEPTA Project Manager. All plans, sketches, and calculations outlined below shall be prepared and sealed by a Professional Engineer licensed in Pennsylvania.

2. The following data shall be required for all hoisting operations adjacent to active SEPTA operations and facilities.
   a. Plans showing location of cranes on the SEPTA Right of Way and all active facilities shall also be shown.
   b. Provide crane rating sheets showing cranes to be adequate for the actual weight being lifted. A complete set of crane charts, including crane, counterweight, and boom nomenclature is to be submitted.
   c. A location plan showing all obstructions such as wires, poles, adjacent structures, etc., and that the proposed lifts are clear of these obstructions.
   d. A data sheet shall be prepared listing the type, size, and arrangements of slings, shackles, or other connecting equipment. Copies of a catalog or information sheets for specialized equipment shall be included.
   e. Temporary support of any components or intermediate stages is to be shown and detailed.
   f. A time schedule of the various stages must be shown as well as a schedule for the entire lifting procedure.

3. SEPTA shall be named as an additional insured for all policies issued for
D. Materials Handling

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

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

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

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

1.09 MICROPROCESSOR SYSTEMS AND SOFTWARE

A. All computer hardware and software to be provided under this Contract, whether
resident within a microprocessor-controlled intelligent subsystem, provided as part of
test or interface equipment, provided for the purpose of post-download data analysis
and processing, or incorporated within training technology, is subject to the
requirements provided in this Specification Section. For the purpose of defining the
work of this Specification Section computer hardware includes computers, laptops,
network switches, network routers, microprocessors, Complex Programmable Logic
Device, Field Programmable Gate Array, Programmable Array Logic System,
Application-Specific Integrated Circuits and other programmable devices.

1.10 SNOW REMOVAL

A. The Contractor shall remove all snow and ice as may be required for the proper
protection and/or in the prosecution of the Work. The Contractor shall at all times
provide and maintain adequate protection against weather so as to preserve all Work,
materials, equipment, apparatus, and fixtures free from injury or damage. No rock salt
or chemicals shall be allowed in the track area or platform area.

1.11 LOCATING UTILITIES

A. The Contractor is required to notify SEPTA and utilities prior to all excavations. The
Contractor shall be held responsible for any damage done to any utility in the
prosecution of the Work. The Contractor shall exercise any precautions necessary to
prevent damage in working underneath or adjacent to any underground structure. If it
becomes necessary for a utility company, through emergency procedures or because of
unforeseen conditions, to repair, reconstruct, relay or relocate utilities within the
Contract area, after work has commenced by the Contractor, the said utility company

and the Contractor shall make suitable arrangements to overcome such interference. No compensation shall be allowed the Contractor for the disruption to his work. A no-cost time extension may be granted in accordance with the Contract to the Contractor by SEPTA for the delay that has occurred. All of the above shall be accomplished at no extra cost or charge to SEPTA.

1.12 ENVIRONMENTAL PROTECTION

A. General Requirements

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

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

3. Compliance of Sub-Contracts with the provisions of this and various other Sections of these Specifications shall be the responsibility of the Contractor.

4. The Contractor shall provide adequate pollution controls for painting and surface preparation in compliance with the State Department of Environmental Resources Regulations.

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

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

2. Solid waste disposal

3. Noise

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

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

6. Degradation of the aesthetic use of the environment

7. Historical, archaeological, and cultural resources.

C. Protection of Natural Resources

1. It is intended that the natural resources within the project boundaries and outside the limits of permanent Work performed shall be preserved in their existing condition or be restored to an equivalent of the existing condition, as approved by the SEPTA Project Manager upon completion of the Work. The Contractor shall confine his onsite construction activities to areas defined by the Contract Drawings and Specifications or directed by the SEPTA Project Manager.
2. Debris or rubbish of any kind shall not be dumped onto the site or roadways. Care shall be taken to prevent damage and injury to personnel, vessels, and vehicles using roadways, or areas accessible to pedestrians. Devices shall be provided and maintained by the Contractor as required to prevent such occurrences.

3. Land Resources
   a. Except in areas indicated to be cleared or excavated, the Contractor shall not remove, cut, deface, injure, or destroy trees, shrubs, or vegetation. No ropes, cables, or guys shall be fastened or attached to any existing nearby trees for anchorage unless otherwise permitted by the SEPTA Project Manager. Where such use is permitted, the Contractor shall be responsible for any resulting damage.
   b. The use of herbicides is not permitted unless otherwise specified.
   c. Repair and Restoration: All trees, vegetation and other landscape features that are to remain and become scarred or damaged by the Contractor's equipment or operations shall be repaired and restored to their original condition at the Contractor's expense. The SEPTA Project Manager shall approve the repair and restoration program prior to its initiation and after completion.

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

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

D. Erosion and Sediment Controls
   1. Burning of ground cover shall not be permitted.
   2. The Contractor shall conform to all applicable requirements of the Department of Environmental Resources of the Commonwealth of Pennsylvania with respect to erosion and sediment control measures to prevent discharge into storm water discharge systems and active waterways.

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

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

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

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

F. Dust Control

1. Dust shall be kept down at all times, including non-Working hours, weekends, and holidays. Soil at the site, station platforms, haul roads, and other areas disturbed by the Contractor’s operations and materials stockpiled for the project. Air blowing shall be permitted only for cleaning off non-particle debris. Sandblasting shall not be permitted except as otherwise specified elsewhere. Only wet cutting of concrete block, concrete, and asphalt shall be permitted.

2. The Contractor shall comply with all applicable provisions of the National Emission Standards for Asbestos (40 CFR 61 Subpart B).

3. The Contractor shall inspect all vehicles for dirt prior to their leaving the construction site. Dirt, soil, and rubble likely to be dislodged during transit shall be removed from the trucks and other vehicles prior to leaving the site.

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

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

G. Smoke, Flammability and Toxicity

1. All applicable materials used in the manufacture of the vehicles shall meet the requirements of the Federal Railroad Administration, United States Department of Transportation as contained in 49 CFR Part 238.103 and its Appendix B. Third
party laboratory certification must be presented to the Engineer for all applicable materials. The Contractor shall also have performed, for review and approval by the Engineer, a fire safety analysis in accordance with 49 CFR Part 238.103 (c). Any exceptions shall be decided by the Engineer. Conformance with the flammability and smoke emission standards is solely the responsibility of the Contractor.

2. All vehicle components shall be designed for the prevention of fire, shall provide protection of the public, employees, and emergency response personnel from injury due to fire, smoke, explosion, or panic due to fire, and shall provide protection of system elements from damage by fire or explosion. Equipment that is a potential fire hazard shall be appropriately isolated from the passenger compartment. Fire stops shall be provided at all floor and roof penetrations. Enclosures for control and other critical equipment shall be located to provide protection against environmental contamination and mechanical damage. The use of polyvinyl chloride (PVC) or polyurethane plastic in the vehicle, except as may be identified in this Technical Specification, is prohibited unless approved by the Engineer.

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

1.13 CONSTRUCTION NOISE CONTROL

A. The intent of this section is to minimize the construction noise effects in the community adjacent to the Project without placing unreasonable restrictions on the construction process. To this end, the Contractor and all Sub-Contractors are required to comply with the operational provisions of this Specification and to use only well- maintained equipment which operates within the maximum noise level limits specified herein and are acoustically certified prior to use on the jobsite.

B. Each prime Contractor and their Sub-Contractors shall perform construction operations in a manner to minimize noise. The Contractors shall provide equipment with efficient noise-suppression devices and employ other noise abatement measures necessary for protection of both employees and the public in accordance with the requirements of the Occupational Safety and Health Act and the current statutory noise limits set by the U.S. Occupational Safety and Health Administration.

C. Compliance with the requirements of this Section will not relieve the Contractors from
responsibility for compliance with state and local ordinances, regulations, and other Sections of these Construction Specifications.

D. Special Requirements

1. Compliance with the requirements of this Section may require the use of equipment with special mufflers or enclosures, and construction of temporary enclosures of sound barriers around noisy operations. It will also be necessary to arrange haul routes to minimize noise at residential sites.

2. The Contractors shall submit drawings of work sites and haul routes showing noise control provisions for the SEPTA Project Manager’s review at the time of the first regularly scheduled job meeting.

3. The Contractors shall promptly inform the SEPTA Project Manager of any complaints received from the public regarding construction noise.

4. Daytime is defined for the purpose of these requirements as the period from 8:00 a.m. to 6:00 p.m. local time daily.

5. Nighttime refers to all other times.

E. Noise Level Restrictions in All Areas

1. Limits: In no case shall the public be exposed to construction noise levels exceeding 100 dBA (SLOW) or to impulsive noise with a peak sound pressure level exceeding 140 dB. A maximum transient sound level of 125 dBC (FAST) can be taken as equivalent to a peak impulsive sound pressure level of 140 dB.

2. Compliance
   a. The Contractors shall submit a noise report to the SEPTA Project Manager for each item of equipment, which is to be used for the Project.
   b. All equipment shall be subject to noise level testing by the SEPTA Project Manager at their discretion. Such tests may be undertaken by the SEPTA Project Manager or their representative as necessary to determine that the equipment in use meets the requirements specified above.

F. Noise Abatement Measures

1. Notwithstanding the specific noise level limitations specified herein, the Contractor shall utilize the noise abatement measures listed below to minimize the noise levels in the community to the greatest extent feasible.
   a. Locate stationary construction equipment as far as possible from residential or hospital buildings, subject to approval by the SEPTA Project Manager. In general, noise-producing equipment shall not be operated within 20 feet of the face of a hospital building or a building with residential occupancy.
   b. Where the minimum distance specified in Paragraph F.1.a above cannot be
achieved, the Contractor shall be required to provide an impervious noise barrier between the equipment and the nearest buildings. Effective acoustical barriers can be constructed of plywood with a minimum thickness of 3/4".

c. Orient stationary construction equipment such that the loudest side of the equipment faces away from the nearest residential or hospital buildings, or such that the equipment is shielded from such buildings, where applicable.

d. Turn off all idling equipment when not in use.

e. Combine noisy construction operations to occur during the same time period rather than during separate time periods.

f. Where feasible, noisy construction operations in the vicinity of residential or hospital buildings shall be performed during daytime hours rather than during nighttime hours, subject to review by the SEPTA Project Manager.

g. Route construction equipment and vehicles over streets and routes that will cause the least disturbance to residents in the vicinity of the Project.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION – NOT APPLICABLE

END OF SECTION
SECTION 01091

REFERENCE STANDARDS

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. Throughout the Contract Documents, references are made to codes and standards which establish qualities and types of workmanship and materials, and which establish methods for testing, programming and reporting on the pertinent characteristics.

B. Various Codes and Standards such as the American Railway Engineering and Maintenance of Way Association (AREMA), American Public Transit Association (APTA), American Society of Mechanical Engineers (ASME), American Society For Testing and Material (ASTM), American National Standards Institute (ANSI), Electronic Industries Alliance (EIA), International Electro-Technical Commission (IEC), International Standards Organization (ISO), International and Regional ITS Architecture and Standards (ITS), Federal Transit Administration (FRA), and Institute of Electrical and Electronic Engineers (IEEE), National Electrical Manufacturers Association (NEMA), National Fire Protection Association (NFPA), Society of Automotive Engineers (SAE) and Underwriters Laboratories (UL) documents mentioned in this Technical Specification are examples acceptable to the Engineer. Material standards and specifications which are used by the Contractor, unless otherwise approved by the Engineer, shall be of those organizations (such as ASME or ASTM) which are based in the United States, or are generally used on a commercial basis in the United States. The applicable document revision shall be that in effect on the date of Proposal submission. Alternate recognized standards may be suggested by Proposers in their detailed Technical Proposal if submitted with sufficient supporting information to establish equivalency.

C. Additionally, the specified standards of this Technical Specification may be replaced with Engineer approved equivalent standards proposed by the Contractor after Contract award. The Contractor shall be required to establish the equivalency and to obtain explicit approval from the Engineer for any substituted documents.

1.02 REFERENCES

A. System Safety Standards

1. The Contractor shall use the following Reference Standards as guidance for the SEPTA CARD System Safety Program.
e. MIL-STD-882C - System Safety Program Requirements
f. MIL-STD-785 - Reliability Program for Systems and Equipment Development and Production
g. MIL-STD-781D - Reliability Testing for Engineering Development, Qualification and Production - Exponential Distribution
h. IEEE 730 - Standard for Software Quality Assurance Plans
i. IEEE 828 - Software Configuration Management Plans
j. IEEE 830 - Recommended Practice for Software Requirements Specifications
k. IEEE 1012 - Standard for Software Verification and Validation Plans
l. IEEE 1016 - Recommended Practice for Software Design Descriptions
m. IEEE 1058.1 - Standard for Software Project Management Plans

B. The following Reference Standards pertain to the CARD Communications System:
   1. Institute of Electrical and Electronics Engineers (IEEE).
      a. 802.11
      b. C62
      c. 10/100BaseT
      d. IEEE 1588
   2. National Electrical Code (NEC)
   3. National Electrical Manufacturers Association (NEMA)
   4. Occupational Safety and Health Administration (OSHA)
   5. Underwriters Laboratories (UL)
   6. Federal Communications Commission (FCC)
      a. FCC Part 15
   7. Military Specifications (MIL)
      a. MIL STD 1344
      b. MIL STD 810
      c. MIL STD 348A
      d. MIL STD 1757
      e. MIL STD 188-124A
      f. MIL STD 202
   8. International Electro technical Commission (IEC)
      a. IEC 61373
      b. IEC 61000-4
      c. IEC 60529 (IP66, IP67, IP68)
      d. IEC 169-4
e. IEC 1024-1

9. Electronic Industries Alliance (EIA)
   a. HDLC
   b. RS232
   c. RS422
   d. RS485
   e. EIA310
   f. TIA-EIA 222G

10. National Fire Protection Association (NFPA)
11. NFPA 780 Telcordia Bellcore
   a. GR-831-CORE

12. Internet Engineering Task Force (IETF)
   a. RMON
   b. SNMP
   c. RFC 1122 d. RFC 1123 e. RFC 1305 f. DHCP

13. International Organization for Standardization
   a. ISO 4523 Metallic Coatings

C. Reference Standards relating to all vehicle equipment design and installation.

D. The Contractor, unless specified otherwise herein, shall follow the requirements of the following standards which shall form a part of this Specification. The edition and addenda of any such standard shall be the current edition or addenda in effect on the Bid Opening date.

   a. Institute of Electrical and Electronic Engineers (IEEE)
   b. American Society for Testing and Materials (ASTM)
   c. Military Standard Procedures MIL-STD 1692A
   e. IEEE Standard 1187-1996, IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Storage Batteries
   g. ANSI-STANDARD C-37-14 and NEMA-STANDARD ICS-1970
   h. Department of Environmental Resources of the Commonwealth of Pennsylvania
   i. Toxic Substance Control Act, P.L. 94-469 (TSCA).
j. American Society for Quality Control (ASQC) Standard ANSI/ASQC Q9001
k. Recommended Requirements for Independent Laboratory Qualifications, published by American Council of Independent Laboratories.

l. ASTM B-329 Standard of Recommended Practice

m. Federal Specifications RR-F-191


PART 2  PRODUCTS – NOT APPLICABLE TO THIS SECTION

PART 3  EXECUTION – NOT APPLICABLE TO THIS SECTION

END OF SECTION
SECTION 01094
DEFINITIONS

PART 1 - GENERAL

1.01 ABBREVIATIONS

A. Definitions pertaining to the CARD system design and equipment description shall conform to the standard definitions promulgated by the following organizations unless otherwise specified within this section:

1. The Institute of Electrical and Electronics Engineers, Inc. (IEEE)
2. Electronic Industries Association (EIA)

B. Where definitions conflict, the order of priority shall be:

1. Specification
2. IEEE
3. EIA

C. Abbreviations:

3G / 4G Third and Fourth Generation Cellular Data
4GL Fourth Generation Language
AAA Authentication, Authorization and Accounting
AAC Asbestos Abatement Contractor
AAR Association of American Railroads
AC Alternating Current
ACC Ancillary Control Center at the Frankford Transportation Center
ACK Acknowledge
ACM Adaptive Code and Modulation
ADA Americans with Disabilities Act
AEIC Association of Edison Illuminating Company
AES Advanced Encryption Standard
AGL Above Ground Level
AIS Alarm Indication Signal
AMBE Advanced Multi-Band Excited
ANSI American National Standards Institute
APC Automatic Passenger Counter
APCO Association of Public-Safety Communications Officials
API Application Program Interface
APTA American Public Transit Association
ASCII American Standard Code for Information Interchange
ASIC Application Specific Integrated Circuit
ASME American Society of Mechanical Engineers
ASTM American Society for Testing and Materials
ASQC American Society for Quality Control
ATO Automatic Time-Out
ATPC Automatic Transmitter Power Control
AVL Automatic Vehicle Location
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWG</td>
<td>American Wire Gauge</td>
</tr>
<tr>
<td>B&amp;B</td>
<td>Buildings and Bridges</td>
</tr>
<tr>
<td>BDA</td>
<td>Bi-Directional Amplifier</td>
</tr>
<tr>
<td>BER</td>
<td>Bit Error Rate</td>
</tr>
<tr>
<td>BIB</td>
<td>Bus-In-A-Box</td>
</tr>
<tr>
<td>BNC</td>
<td>Bayonet Neill-Concelman</td>
</tr>
<tr>
<td>BPS</td>
<td>Bits per second</td>
</tr>
<tr>
<td>BSL</td>
<td>Broad Street Line</td>
</tr>
<tr>
<td>BSS</td>
<td>Broad Street Subway</td>
</tr>
<tr>
<td>C&amp;S</td>
<td>Communications and Signals</td>
</tr>
<tr>
<td>C/I+N</td>
<td>Carrier to Interference Plus Noise Ratio</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer-Aided Dispatch</td>
</tr>
<tr>
<td>CAD/AVL</td>
<td>Computer-Aided Dispatch/Automatic Vehicle Location</td>
</tr>
<tr>
<td>CAP</td>
<td>Compliance Assessment Program</td>
</tr>
<tr>
<td>CARD</td>
<td>Computer-Aided Radio Dispatch System</td>
</tr>
<tr>
<td>CATP</td>
<td>Coverage Acceptance Test Plan</td>
</tr>
<tr>
<td>CCT</td>
<td>Customized Community Transportation</td>
</tr>
<tr>
<td>CCTV</td>
<td>Closed-Circuit Television</td>
</tr>
<tr>
<td>CDRL</td>
<td>Contract Deliverable Requirement List</td>
</tr>
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<td>CDT</td>
<td>Central Diagnostic Terminal</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>CIL</td>
<td>Central Instrument Location</td>
</tr>
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<td>CM</td>
<td>Communications Managers</td>
</tr>
<tr>
<td>CMP</td>
<td>Configuration Management Plan</td>
</tr>
<tr>
<td>ConOps</td>
<td>Concept of Operations</td>
</tr>
<tr>
<td>COP</td>
<td>City of Philadelphia</td>
</tr>
<tr>
<td>COS</td>
<td>Carrier Operated Squelch</td>
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<tr>
<td>COTS</td>
<td>Commercial-Off-the-Shelf</td>
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<td>CPC</td>
<td>Channel Performance Criteria</td>
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<td>CPLD</td>
<td>Complex Programmable Logic Device</td>
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<tr>
<td>CPM</td>
<td>Cycles Per Minute</td>
</tr>
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<td>CPU</td>
<td>Central Processing Unit</td>
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<tr>
<td>CRC</td>
<td>Cyclic Redundancy Check</td>
</tr>
<tr>
<td>CS</td>
<td>Carrier Sense</td>
</tr>
<tr>
<td>CSMA</td>
<td>Carrier Sense Multiple Access</td>
</tr>
<tr>
<td>CSSI</td>
<td>Console Subsystem Interface</td>
</tr>
<tr>
<td>CSSP</td>
<td>Cybersecurity Service Provider</td>
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<tr>
<td>CTC</td>
<td>Centralized Traffic Control</td>
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<td>CTCSS</td>
<td>Continuous Tone-Coded Squelch System</td>
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<td>CTV</td>
<td>Cable TV</td>
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<tr>
<td>CW/CCW</td>
<td>Clockwise/Counter-Clockwise</td>
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<td>D&amp;MS</td>
<td>Data and Maintenance System</td>
</tr>
<tr>
<td>DAQ</td>
<td>Delivered Audio Quality</td>
</tr>
<tr>
<td>DAS</td>
<td>Direct Attached Storage</td>
</tr>
<tr>
<td>dB</td>
<td>Decibels</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>DCS</td>
<td>Distributed Communications System</td>
</tr>
<tr>
<td>DES</td>
<td>Data Encryption Standard</td>
</tr>
<tr>
<td>DFM</td>
<td>Dispersive Fade Margin</td>
</tr>
<tr>
<td>DHCP</td>
<td>Dynamic Host Configuration Protocol</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>DHHS</td>
<td>Department of Health and Human Services</td>
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<tr>
<td>DMZ</td>
<td>Demilitarized Zone</td>
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<tr>
<td>DNS</td>
<td>Domain Name System</td>
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<td>DOT</td>
<td>Department of Transportation</td>
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<tr>
<td>DST</td>
<td>Daylight Savings Time</td>
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<td>DVD</td>
<td>Digital Versatile Disc</td>
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<tr>
<td>DVI</td>
<td>Digital Visual Interface</td>
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<tr>
<td>EA</td>
<td>Emergency Alarm</td>
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<tr>
<td>EAP</td>
<td>Extensible Authentication Protocol</td>
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<tr>
<td>ECD</td>
<td>External Configuration Device</td>
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<tr>
<td>ECM</td>
<td>Electronic Control Module</td>
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<td>ECN</td>
<td>Engineering Change Notice</td>
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<tr>
<td>ECSB</td>
<td>Engineering Change Service Bulletin</td>
</tr>
<tr>
<td>EEPROM</td>
<td>Electronic Erasable Programmable Read-Only Memory</td>
</tr>
<tr>
<td>EIA</td>
<td>Electronic Industries Association</td>
</tr>
<tr>
<td>EIC</td>
<td>Employee in Charge</td>
</tr>
<tr>
<td>ELF</td>
<td>Extremely Low Frequency</td>
</tr>
<tr>
<td>EMAIL</td>
<td>Electronic Mail</td>
</tr>
<tr>
<td>EMF</td>
<td>Electromagnetic Field</td>
</tr>
<tr>
<td>EMI</td>
<td>Electromagnetic Interference</td>
</tr>
<tr>
<td>EOL</td>
<td>End of Life</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
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<tr>
<td>ERD</td>
<td>Entity Relationship Diagram</td>
</tr>
<tr>
<td>ERP</td>
<td>Effective Radiated Power</td>
</tr>
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<td>ERS</td>
<td>Event Recorder System</td>
</tr>
<tr>
<td>EVIS</td>
<td>Electronic Vehicle Inspection System</td>
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<tr>
<td>FAI</td>
<td>First Article Inspection</td>
</tr>
<tr>
<td>FAT</td>
<td>Factory Acceptance Test</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
</tr>
<tr>
<td>FDM</td>
<td>Frequency Division Multiplexing</td>
</tr>
<tr>
<td>FDMA</td>
<td>Frequency Division Multiple Access</td>
</tr>
<tr>
<td>FDR</td>
<td>Final Design Review</td>
</tr>
<tr>
<td>FEC</td>
<td>Forward Error Correction</td>
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<td>FFT</td>
<td>Functional Fault Tree</td>
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<td>FM</td>
<td>Frequency Modulation</td>
</tr>
<tr>
<td>FMEA</td>
<td>Failure Modes and Effects Analysis</td>
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<td>FMI</td>
<td>Field Modification Instructions</td>
</tr>
<tr>
<td>FO</td>
<td>Fiber Optic</td>
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<td>FPGA</td>
<td>Field Programmable Gate Array</td>
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<td>FRA</td>
<td>Federal Railroad Administration</td>
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<td>FRP</td>
<td>Fragmentation Protocol</td>
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<tr>
<td>FTA</td>
<td>Federal Transit Administration</td>
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<tr>
<td>FTC</td>
<td>Frankford Transportation Center</td>
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<td>FTP</td>
<td>File Transfer Protocol</td>
</tr>
<tr>
<td>GB</td>
<td>Gigabyte</td>
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<td>GIS</td>
<td>Geographic Information System</td>
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<td>GPRS</td>
<td>General Packet Radio Service</td>
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<td>GPS</td>
<td>Global Positioning System</td>
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<tr>
<td>GTFS</td>
<td>General Transit Feed Specification</td>
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<tr>
<td>GTFS-RT</td>
<td>General Transit Feed Specification Real-time</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
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<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>HDLC</td>
<td>High-Level Data Link Control</td>
</tr>
<tr>
<td>HDMI</td>
<td>High Definition Multimedia Interface</td>
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<tr>
<td>HL</td>
<td>Hazard Log</td>
</tr>
<tr>
<td>HMI</td>
<td>Human Machine Interface</td>
</tr>
<tr>
<td>HTML</td>
<td>Hypertext Markup Language</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation, and Air Conditioning equipment</td>
</tr>
<tr>
<td>Hz</td>
<td>Hertz</td>
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<tr>
<td>I/O</td>
<td>Input/Output</td>
</tr>
<tr>
<td>ICD</td>
<td>Interface Control Document</td>
</tr>
<tr>
<td>ID</td>
<td>Identification</td>
</tr>
<tr>
<td>IDD</td>
<td>Interface Design Document</td>
</tr>
<tr>
<td>IDPS</td>
<td>Intrusion Detection and Protection System</td>
</tr>
<tr>
<td>IDS</td>
<td>Intrusion Detection System</td>
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<tr>
<td>IEC</td>
<td>International Electro-technical Commission</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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<td>IETF</td>
<td>Internet Engineering Task Force</td>
</tr>
<tr>
<td>IHA</td>
<td>Interface Hazard Analysis</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
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<tr>
<td>IPC</td>
<td>Illustrated Parts Catalog</td>
</tr>
<tr>
<td>IPCEA</td>
<td>Insulated Power Cable Engineers Association</td>
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<tr>
<td>IPS</td>
<td>Intrusion Protection System</td>
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<tr>
<td>ISA</td>
<td>Instrument Society of America</td>
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<tr>
<td>ISO</td>
<td>International Standards Organization</td>
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<tr>
<td>ISR</td>
<td>Interrupt Service Routine</td>
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<tr>
<td>ISSI</td>
<td>Inter RF Subsystem Interface</td>
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<tr>
<td>ITS</td>
<td>Intelligent Transportation Systems</td>
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<tr>
<td>ITTP</td>
<td>Integrated Trouble Ticket Package</td>
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<tr>
<td>ITU-T</td>
<td>International Communications Union - Telecommunications</td>
</tr>
<tr>
<td>IVCU</td>
<td>Intelligent Vehicle Control Unit</td>
</tr>
<tr>
<td>IVN</td>
<td>Intelligent Vehicle Network</td>
</tr>
<tr>
<td>IVU</td>
<td>Intelligent Vehicle Unit</td>
</tr>
<tr>
<td>JEDEC</td>
<td>Joint Electron Device Engineering Council</td>
</tr>
<tr>
<td>kHz</td>
<td>KiloHertz</td>
</tr>
<tr>
<td>KMF</td>
<td>Key Management Facility</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>LAPB</td>
<td>Link Access Procedure, Balanced</td>
</tr>
<tr>
<td>LCD</td>
<td>Liquid Crystal Display</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>LLRU</td>
<td>Lowest Line Replaceable Unit</td>
</tr>
<tr>
<td>LMR</td>
<td>Land Mobile Radio</td>
</tr>
<tr>
<td>LRU</td>
<td>Line Replaceable Unit</td>
</tr>
<tr>
<td>LTE</td>
<td>Long-Term Evolution</td>
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<tr>
<td>LVPS</td>
<td>Low Voltage Power Supply</td>
</tr>
<tr>
<td>MAC</td>
<td>Media Access Control</td>
</tr>
<tr>
<td>MAC</td>
<td>Maintenance Allocation Chart</td>
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<tr>
<td>MCM</td>
<td>Mobile Communication Manager</td>
</tr>
<tr>
<td>MCP</td>
<td>Mobile Communications Package</td>
</tr>
<tr>
<td>MDBF</td>
<td>Mean Distance between Failures</td>
</tr>
<tr>
<td>MDT</td>
<td>Mobile Data Terminal</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>MEP</td>
<td>Mechanical, Electrical and Plumbing</td>
</tr>
<tr>
<td>MEP/A</td>
<td>Mechanical, Electrical, Plumbing and Air Conditioning</td>
</tr>
<tr>
<td>MFL</td>
<td>Market-Frankford Line</td>
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<tr>
<td>MFT</td>
<td>Mini-Fleet Test</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>MIB</td>
<td>Management Information Base</td>
</tr>
<tr>
<td>MIL</td>
<td>Military Specifications</td>
</tr>
<tr>
<td>MIL-STD</td>
<td>Military Standard</td>
</tr>
<tr>
<td>MOM</td>
<td>Manager of Managers</td>
</tr>
<tr>
<td>MP</td>
<td>Married Pair</td>
</tr>
<tr>
<td>MPH</td>
<td>Miles Per Hour</td>
</tr>
<tr>
<td>MPLS</td>
<td>Multiprotocol Label Switching</td>
</tr>
<tr>
<td>MS</td>
<td>Microsoft</td>
</tr>
<tr>
<td>MSDS</td>
<td>Material Safety Data Sheets</td>
</tr>
<tr>
<td>MSHL</td>
<td>Media-Sharon Hill Line</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time between Failures</td>
</tr>
<tr>
<td>MTTHE</td>
<td>Mean Time to Hazardous Event</td>
</tr>
<tr>
<td>MTTR</td>
<td>Mean Time to Repair</td>
</tr>
<tr>
<td>NAT</td>
<td>Network Address Translation</td>
</tr>
<tr>
<td>NE</td>
<td>Network Element</td>
</tr>
<tr>
<td>NEC</td>
<td>National Electrical Code</td>
</tr>
<tr>
<td>NEC</td>
<td>Northeast Corridor (Amtrak territory)</td>
</tr>
<tr>
<td>NEM</td>
<td>Network Elements Manager</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
</tr>
<tr>
<td>NERC</td>
<td>North American Electric Reliability Corporation</td>
</tr>
<tr>
<td>NESC</td>
<td>National Electrical Safety Code</td>
</tr>
<tr>
<td>NFPA</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td>NGIPS</td>
<td>Next-Generation Intrusion Prevention System</td>
</tr>
<tr>
<td>NHSL</td>
<td>Norristown High Speed Line</td>
</tr>
<tr>
<td>NIST</td>
<td>National Institute of Standards and Technology</td>
</tr>
<tr>
<td>NM</td>
<td>Network Manager</td>
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<td>NMS</td>
<td>Network Management System</td>
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<tr>
<td>NSS</td>
<td>Network Security System</td>
</tr>
<tr>
<td>NTCIP</td>
<td>National Transportation Communications for ITS Protocol</td>
</tr>
<tr>
<td>NTD</td>
<td>National Transit Database</td>
</tr>
<tr>
<td>NTP</td>
<td>Notice to Proceed</td>
</tr>
<tr>
<td>O&amp;SHA</td>
<td>Operation and Support Hazard Analysis</td>
</tr>
<tr>
<td>OBC</td>
<td>Onboard Computer</td>
</tr>
<tr>
<td>ODBC</td>
<td>Open Database Connectivity</td>
</tr>
<tr>
<td>OEM</td>
<td>Original Equipment Manufacturer</td>
</tr>
<tr>
<td>OLES</td>
<td>Office of Law Enforcement Standards</td>
</tr>
<tr>
<td>OSF</td>
<td>Open Software Foundation</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Safety and Health Administration</td>
</tr>
<tr>
<td>OSR</td>
<td>On-Site Response</td>
</tr>
<tr>
<td>OTA</td>
<td>Over The Air</td>
</tr>
<tr>
<td>OTN</td>
<td>Optical Transport Network</td>
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<tr>
<td>P25</td>
<td>Project 25</td>
</tr>
<tr>
<td>PA</td>
<td>Public Address</td>
</tr>
<tr>
<td>PAL</td>
<td>Programmable Array Logic</td>
</tr>
<tr>
<td>PAP</td>
<td>Password Authentication Protocol</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Full Form</td>
</tr>
<tr>
<td>--------------</td>
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</tr>
<tr>
<td>PC</td>
<td>Personal Computer</td>
</tr>
<tr>
<td>PCB</td>
<td>Printed Circuit Board</td>
</tr>
<tr>
<td>PCC</td>
<td>Presidents Conference Committee Car</td>
</tr>
<tr>
<td>PCI</td>
<td>Peripheral Component Interconnect</td>
</tr>
<tr>
<td>PCO</td>
<td>Potential Change Order</td>
</tr>
<tr>
<td>PDC</td>
<td>Primary Domain Controller</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable Document Format</td>
</tr>
<tr>
<td>PDR</td>
<td>Preliminary Design Review</td>
</tr>
<tr>
<td>PECO</td>
<td>Philadelphia Electric Company</td>
</tr>
<tr>
<td>PHA</td>
<td>Preliminary Hazard Analysis</td>
</tr>
<tr>
<td>PHL</td>
<td>Preliminary Hazard List</td>
</tr>
<tr>
<td>PIM</td>
<td>Passive Intermodulation</td>
</tr>
<tr>
<td>PMIS</td>
<td>Project Management Information System</td>
</tr>
<tr>
<td>PoE</td>
<td>Power Over Ethernet</td>
</tr>
<tr>
<td>PPM</td>
<td>Parts Per Million or Pages Per Minute</td>
</tr>
<tr>
<td>PPS</td>
<td>Pulse per Second</td>
</tr>
<tr>
<td>PRBS</td>
<td>Pseudo-Random Binary Sequence</td>
</tr>
<tr>
<td>PROM</td>
<td>Programmable Read-Only Memory</td>
</tr>
<tr>
<td>PRTT</td>
<td>Priority-Request-to-Talk</td>
</tr>
<tr>
<td>PSP</td>
<td>Product Safety Plan</td>
</tr>
<tr>
<td>PSTN</td>
<td>Public Switched Telephone Network</td>
</tr>
<tr>
<td>PTP</td>
<td>Precision Time Protocol</td>
</tr>
<tr>
<td>PTC</td>
<td>Positive Train Control</td>
</tr>
<tr>
<td>PTT</td>
<td>Push-to-Talk</td>
</tr>
<tr>
<td>PVC</td>
<td>Polyvinyl Chloride</td>
</tr>
<tr>
<td>PVCIS</td>
<td>Pre-Trip and Vehicle Condition Inspection System</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
</tr>
<tr>
<td>QAM</td>
<td>Quadrature Amplitude Modulation</td>
</tr>
<tr>
<td>QC</td>
<td>Quality Control</td>
</tr>
<tr>
<td>QoS</td>
<td>Quality of Service</td>
</tr>
<tr>
<td>QPSK</td>
<td>Quadrature Phase-Shift Keying</td>
</tr>
<tr>
<td>RADIUS</td>
<td>Remote Authentication Dial-In User Service</td>
</tr>
<tr>
<td>RAID</td>
<td>Redundant Array of Independent Disks</td>
</tr>
<tr>
<td>RAM</td>
<td>Random Access Memory</td>
</tr>
<tr>
<td>RAM</td>
<td>Reliability, Availability and Maintainability</td>
</tr>
<tr>
<td>RCP</td>
<td>Radio Control Protocol</td>
</tr>
<tr>
<td>RF</td>
<td>Radio Frequency</td>
</tr>
<tr>
<td>RFA</td>
<td>Request for Amendment</td>
</tr>
<tr>
<td>RFC</td>
<td>Request for Comments</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
</tr>
<tr>
<td>RFI</td>
<td>Request for Information</td>
</tr>
<tr>
<td>RFID</td>
<td>Radio Frequency Identification</td>
</tr>
<tr>
<td>RFP</td>
<td>Request for Proposal</td>
</tr>
<tr>
<td>RMON</td>
<td>Remote Network Monitoring</td>
</tr>
<tr>
<td>RMS</td>
<td>Root Mean Squared</td>
</tr>
<tr>
<td>ROCC</td>
<td>Rail Operations Control Center</td>
</tr>
<tr>
<td>RoHS</td>
<td>Restriction of the Use of Certain Hazardous Substances</td>
</tr>
<tr>
<td>ROM</td>
<td>Read-Only Memory</td>
</tr>
<tr>
<td>ROW</td>
<td>Right Of Way</td>
</tr>
<tr>
<td>RS</td>
<td>Recommended Standard</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td>RSA</td>
<td>Route and Schedule Adherence</td>
</tr>
<tr>
<td>RSL</td>
<td>Received Signal Level</td>
</tr>
<tr>
<td>RSSI</td>
<td>Received Signal Strength Indicator</td>
</tr>
<tr>
<td>RTM</td>
<td>Requirements Traceability Matrix</td>
</tr>
<tr>
<td>RTPI</td>
<td>Real-Time Passenger Information</td>
</tr>
<tr>
<td>RTT</td>
<td>Request-to-Talk</td>
</tr>
<tr>
<td>RTU</td>
<td>Remote Terminal Unit (for NMS)</td>
</tr>
<tr>
<td>SAC</td>
<td>Safety Assurance Concept</td>
</tr>
<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
</tr>
<tr>
<td>SAN</td>
<td>Storage Area Network</td>
</tr>
<tr>
<td>SASP</td>
<td>Safety Assurance and System Performance</td>
</tr>
<tr>
<td>SATA</td>
<td>Serial Advanced Technology Attachment</td>
</tr>
<tr>
<td>SATP</td>
<td>System Acceptance Test Plan</td>
</tr>
<tr>
<td>SD</td>
<td>Space Diversity</td>
</tr>
<tr>
<td>SDD</td>
<td>Software Design Description</td>
</tr>
<tr>
<td>SDoC</td>
<td>Supplier Declaration of Conformance</td>
</tr>
<tr>
<td>SEPTA</td>
<td>Southeastern Pennsylvania Transportation Authority</td>
</tr>
<tr>
<td>SFA</td>
<td>System Functional Analysis</td>
</tr>
<tr>
<td>SFP</td>
<td>Small Form Pluggable</td>
</tr>
<tr>
<td>SHA</td>
<td>System Hazard Analysis</td>
</tr>
<tr>
<td>SHL</td>
<td>System Hazard List</td>
</tr>
<tr>
<td>SIEM</td>
<td>Security Incident and Event Monitoring</td>
</tr>
<tr>
<td>SINAD</td>
<td>Signal-to-Noise and Distortion Ratio</td>
</tr>
<tr>
<td>SMS</td>
<td>Short Message Service</td>
</tr>
<tr>
<td>SNMP</td>
<td>Simple Network Management Protocol</td>
</tr>
<tr>
<td>SNR</td>
<td>Signal-to-Noise Ratio</td>
</tr>
<tr>
<td>SOW</td>
<td>Statement Of Work</td>
</tr>
<tr>
<td>SQA</td>
<td>Software Quality Assurance</td>
</tr>
<tr>
<td>SQL</td>
<td>Structured Query Language</td>
</tr>
<tr>
<td>SRS</td>
<td>Systems Requirements Specification</td>
</tr>
<tr>
<td>SSHA</td>
<td>Subsystem Hazard Analysis</td>
</tr>
<tr>
<td>SSHL</td>
<td>Subsystem Hazard List</td>
</tr>
<tr>
<td>SSP</td>
<td>System Safety Program</td>
</tr>
<tr>
<td>SSPP</td>
<td>System Safety Program Plan</td>
</tr>
<tr>
<td>SSWP</td>
<td>Site Specific Work Plan</td>
</tr>
<tr>
<td>STD</td>
<td>Standard</td>
</tr>
<tr>
<td>SWC</td>
<td>Surge Withstand Capability</td>
</tr>
<tr>
<td>SYRS</td>
<td>System Requirements Specification</td>
</tr>
<tr>
<td>TAN</td>
<td>Transport Area Network</td>
</tr>
<tr>
<td>TCIP</td>
<td>Transit Communications Interface Profiles</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>Transmission Control Protocol / Internet Protocol</td>
</tr>
<tr>
<td>TDI</td>
<td>Time Domain Interference</td>
</tr>
<tr>
<td>TDMA</td>
<td>Time Division Multiple Access</td>
</tr>
<tr>
<td>TFTP</td>
<td>Trivial File Transfer Protocol</td>
</tr>
<tr>
<td>TIA</td>
<td>Telecommunications Industry Association</td>
</tr>
<tr>
<td>TIGER</td>
<td>Topologically Integrated Geographic Encoding and Referencing</td>
</tr>
<tr>
<td>TL1</td>
<td>Transaction Language 1</td>
</tr>
<tr>
<td>TLA</td>
<td>Three Letter Acronym</td>
</tr>
<tr>
<td>TSB</td>
<td>Transportation Safety Board</td>
</tr>
<tr>
<td>TSP</td>
<td>Traffic Signal Priority</td>
</tr>
</tbody>
</table>
1.02 DEFINITIONS

Administrator-adjustable
Modifiable via workstation displays accessible only by a System Administrator.

Alarm
A CARD System event that audibly and visually alerts one or more CARD System users to the presence of a condition that requires immediate attention.

Archive
To copy files to a long-term storage medium, typically offline. The System Administrator will archive files from online disk storage to a second offline storage device utilizing either, or both, hard and removable media.

Authority
The Southeastern Pennsylvania Transportation Authority (SEPTA)

CARD System
01094-8
Definitions
March 2021
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block</td>
<td>Work performed by a revenue vehicle between leaving and returning to a depot or other vehicle base</td>
</tr>
<tr>
<td>Bus</td>
<td>Revenue vehicles for providing the SEPTA Fixed-route and Flex-Route service.</td>
</tr>
<tr>
<td>Bus Operator</td>
<td>A person who operates a revenue transit vehicle.</td>
</tr>
<tr>
<td>CARD System</td>
<td>The system described in this Technical Specification and to be supplied by the Contractor under this Contract.</td>
</tr>
<tr>
<td>CARD System User</td>
<td>A user who interacts directly with the CARD System via a workstation on the CARD System domain.</td>
</tr>
<tr>
<td>Central Site</td>
<td>Location of the CARD System servers and communications devices (e.g., SEPTA’s Server Room).</td>
</tr>
<tr>
<td>Console</td>
<td>A dispatch operating position consisting of office, modular or customized furniture with one or more workstations and user interaction devices integrated into the furniture.</td>
</tr>
<tr>
<td>Contract</td>
<td>The complete agreement between the two parties regarding, in this case, the procurement of a complete CARD System, including all equipment, services, warranties, etc.</td>
</tr>
<tr>
<td>(The) Contractor</td>
<td>The successful Bidder who is awarded a Contract for providing all facilities, equipment, software and services described in these Specifications for the CARD Project.</td>
</tr>
<tr>
<td>Data Dictionary</td>
<td>A set of data descriptions and relationships depicting the database structure that can be utilized by the System Administrator for one or more applications.</td>
</tr>
<tr>
<td>Deadhead</td>
<td>Non-revenue movement of a revenue vehicle before, between, and after revenue trips.</td>
</tr>
<tr>
<td>Destination Sign(s)</td>
<td>Sign(s) located on the outside of a revenue vehicle denoting the route of that vehicle, typically the route number and name. Also referred to as a headsign.</td>
</tr>
<tr>
<td>Depot</td>
<td>SEPTA facilities where SEPTA vehicles are parked, maintained and fueled.</td>
</tr>
<tr>
<td>Detour</td>
<td>The act of rerouting one or more buses off of their regular route due to construction, accident, or other obstructions. Also referred to as a “reroute”.</td>
</tr>
<tr>
<td>Dispatch</td>
<td>Centralized dispatch facility located at SEPTA’s facility in Philadelphia, Pennsylvania.</td>
</tr>
</tbody>
</table>
Dispatcher: Operations personnel who monitor and manage SEPTA's revenue service and non-revenue operations.

Display: An organized presentation of data and display elements in a window intended to provide user access to specific functional capabilities and information.

Display Elements: Basic elements that are used to construct all displays; such as fields, list boxes, scroll bars, radio buttons, text, graphics, etc.

Dwell (or Dwell Time): The period of time measured from the instant a vehicle stops until the instant it resumes motion.

Engineer: SEPTA's Consultant.

Event: An occurrence that is detected, recorded, and possibly annunciated by the CARD System. Examples include emergency alarms, RTTs, PRTTs, text and data messages, and Operator logon/logoff.

Extraboard: 1.) The bus Operators who fill in for regularly assigned Operators who are absent for any reason, as well as driving open runs and trips (including vacation and regular days off) 2.) The daily list of assignments for these bus Operators.

Extra Service: Refers to trips added for special events.

Factory Acceptance Test: A series of tests at the Contractor's factory to demonstrate correct operation of all functions using the fully integrated CARD System, including all fixed-end hardware and software, workstations and related equipment, all fixed-site radio equipment, and a subset of on-board vehicle equipment.

Fill-In: Covering lost service with another bus and Operator.

Fixed-End: The location at which system equipment is permanently installed; as opposed to mobile.

Function Key: A device, either a physical pushbutton, a function key on the keyboard, or a programmable function key or selection field on displays that the user employs to interact with the computer system. The functionality of a function key may also be provided using a button on the Cursor Positioning Device.

General Transit Feed Specification -: Defines a common format for public transportation schedules and associated geographic information.

General Transit Feed Specification Real-time -: GTFS-RT is a specification that allows public transportation agencies to provide real-time updates about their fleet. It is an extension to GTFS.

Geocoding: The conversion of bus stops, street addresses, intersections, and landmarks to geographic coordinates.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIS</td>
<td>Geographic Information System, a system that contains spatially referenced data that can be analyzed and converted to information for a specific set of purposes and applications.</td>
</tr>
<tr>
<td>Headway</td>
<td>Scheduled or actual time between two consecutive trips at a time point.</td>
</tr>
<tr>
<td>Hot</td>
<td>A bus running ahead of schedule (e.g., running hot).</td>
</tr>
<tr>
<td>Incident Information Server -</td>
<td>An abnormal event that is documented by an Incident Report Server that contains a copy of the CARD System data so that the data is accessible by other systems and off-line users</td>
</tr>
<tr>
<td>Intelligent Transportation Systems -</td>
<td>Refers to a wide range of advanced electronics, communications, control, computer, and other technologies designed to improve safety and productivity, reduce roadway congestion, and encourage transit use.</td>
</tr>
<tr>
<td>Intelligent Vehicle Control Unit -</td>
<td>A computer in a mobile installation that integrates, monitors and controls vehicle devices and functions. In some cases, the IVCU is integrated into a single package with the Vehicle Control Head (VCH).</td>
</tr>
<tr>
<td>Interface Control Document</td>
<td>A formal, comprehensive, detailed document used to define an interface between two devices or systems.</td>
</tr>
<tr>
<td>KEY Program</td>
<td>The SEPTA Key Fare Program is a new way to pay to ride on SEPTA. The Key Card is a contactless chip card that can be loaded and reloaded without having to get a new Card. Validators have been added to existing fareboxes on all buses, trackless trolleys, trolleys (City and Suburban) and the Norristown High Speed Line. Customers using a Key Card will pass it across the Validator screen and those using cash (bills and coins) and tokens (for as long as they are accepted) will continue to put them in the appropriate slots at the top of the farebox.</td>
</tr>
<tr>
<td>Late</td>
<td>A revenue vehicle that is operating behind schedule by more than the defined late tolerance.</td>
</tr>
<tr>
<td>Layover</td>
<td>Time scheduled to be spent waiting between trips or waiting for transfers at a layover zone or transit center.</td>
</tr>
<tr>
<td>Layover Zone</td>
<td>Designated place for layovers to occur.</td>
</tr>
<tr>
<td>Leader</td>
<td>A bus of the same route immediately ahead of a given bus (the &quot;Follower&quot;).</td>
</tr>
<tr>
<td>Local Workstation</td>
<td>A CARD System workstation that is connected directly to the CARD System LAN</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loop</td>
<td>A route or part of a route that is circular in nature providing overlapping service and served by buses traveling in one or both directions.</td>
</tr>
<tr>
<td>Lost Time</td>
<td>The time during which scheduled bus service does not occur. Lost time may be due to accident, equipment failure, unavailable Operator, illness, medical emergency, police action, or construction delays.</td>
</tr>
<tr>
<td>Manifest</td>
<td>A sequential listing of pick-ups and drop-offs, including associated information, indicating the day's scheduled work for a flex-route block/run.</td>
</tr>
<tr>
<td>Meet</td>
<td>Any arranged meeting of revenue vehicles at a particular location in order to facilitate the transfer of passengers.</td>
</tr>
<tr>
<td>Missed pullout</td>
<td>A bus missing its scheduled departure from a depot or vehicle storage facility due to either no Operator or no available vehicle.</td>
</tr>
<tr>
<td>Mobile Radio</td>
<td>A radio transmitter/receiver installed in a vehicle.</td>
</tr>
<tr>
<td>Mobile User</td>
<td>A user who interacts directly with the CARD System via on-board vehicle equipment.</td>
</tr>
<tr>
<td>Monitor</td>
<td>A device used to display the GUI of a computer system to the user.</td>
</tr>
<tr>
<td>No Show</td>
<td>A flex-route customer that does not appear for the scheduled trip (within the pickup window).</td>
</tr>
<tr>
<td>Off-route Trip</td>
<td>Undefined movement of a revenue vehicle, for which timepoints, bus stops, and a schedule are not defined.</td>
</tr>
<tr>
<td>On-demand Stop</td>
<td>Stop requested by a passenger. This stop is not part of a schedule or manifest.</td>
</tr>
<tr>
<td>Online Manifest</td>
<td>A system that provides flex-route operators with electronic access to their manifests in the vehicles. Capabilities typically include support for dynamic updates to the manifest during service and the ability for operators to provide immediate updates trip status during the course of service.</td>
</tr>
<tr>
<td>Operator</td>
<td>SEPTA personnel assigned the responsibility of operating the fixed-route and flex-route vehicles.</td>
</tr>
<tr>
<td>Operator ID</td>
<td>A unique identifier assigned to each Operator for logon purposes. The Operator ID is typically the same as the employee badge number.</td>
</tr>
<tr>
<td>Owner</td>
<td>The Southeastern Pennsylvania Transportation Authority (SEPTA)</td>
</tr>
<tr>
<td>Paddle</td>
<td>A description of a full day's service for an operator, including route description, scheduled times, and comments.</td>
</tr>
<tr>
<td>CARD System</td>
<td>01094-12 Definitions March 2021</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>------</td>
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</tr>
<tr>
<td>Pattern</td>
<td>The scheduled sequence of stops for one or more block trips. An ordered set of one or more patterns define a trip.</td>
</tr>
<tr>
<td>Peak</td>
<td>A period of time of increased transit service (i.e., the AM and/or PM commuter rush hour period).</td>
</tr>
<tr>
<td>Peak service</td>
<td>The transit service provided during the AM and PM peak.</td>
</tr>
<tr>
<td>Pickup Window</td>
<td>Period beginning at the scheduled pick-up time provided to a passenger and ending a predefined time later.</td>
</tr>
<tr>
<td>Priority-Request-to-Talk</td>
<td>A high-priority request for voice communications issued by an Operator or other mobile user to Dispatch. A PRTT is typically given the second highest priority in the CAD system following an Emergency Alarm.</td>
</tr>
<tr>
<td>Project Manager</td>
<td>SEPTA Project Manager or his/her representative.</td>
</tr>
<tr>
<td>Provide</td>
<td>As used in the &quot;Technical Provisions&quot; Section of these Specifications, the word &quot;provide&quot; means &quot;design, furnish, install, test, and document, in the manner specified, and to the greatest extent compatible with the intent and limits of the Specifications.&quot;</td>
</tr>
<tr>
<td>Pullout</td>
<td>1.) A bus leaving its depot; 2.) The scheduled time of a pullout</td>
</tr>
<tr>
<td>Radio Console</td>
<td>A panel of switches and indicators, or a computer display that is used to directly monitor and control a radio system.</td>
</tr>
<tr>
<td>Radio Instrument House</td>
<td>A prefabricated steel structure which houses the wayside encoder and base communications systems and all ancillary equipment.</td>
</tr>
<tr>
<td>Radio System</td>
<td>The SEPTA system that includes the fixed-site and mobile radio equipment.</td>
</tr>
<tr>
<td>Redundancy</td>
<td>The existence in a system of more than one means of accomplishing a given function, for purpose of increasing security or reliability.</td>
</tr>
<tr>
<td>Reliability</td>
<td>The probability of performing a specified function, without failure and within design parameters, for the period of time intended under actual operating conditions.</td>
</tr>
<tr>
<td>Relief Operator</td>
<td>An Operator who relieves another Operators. Primarily used for continuing service without taking the bus out of service.</td>
</tr>
<tr>
<td>Relief Point</td>
<td>A specified location at which an Operator relief has occurred or is scheduled to occur.</td>
</tr>
<tr>
<td>Remote Workstation</td>
<td>A CARD System workstation that must link to the CARD System LAN via the SEPTA WAN infrastructure.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Replacement Vehicle</td>
<td>The vehicle assigned to replace another vehicle on the road, typically due to mechanical problems or accident.</td>
</tr>
<tr>
<td>Report</td>
<td>A periodic or on-demand accumulation or summary of selected database and/or historical data that is compiled, sorted, formatted, and stored according to user and System Administrator specified directions and parameters. A report may be printed, displayed on a monitor, and/or stored as a file for subsequent access.</td>
</tr>
<tr>
<td>Revenue Service</td>
<td>The transportation of passengers who have paid a fare.</td>
</tr>
<tr>
<td>Revenue System</td>
<td>The portion of the SEPTA System on which revenue service is conducted.</td>
</tr>
<tr>
<td>Right-of-Way</td>
<td>The land occupied by the rail transit system, especially for its main line. The right of traffic on a given route to take precedence.</td>
</tr>
<tr>
<td>Right-of-Way Hazard</td>
<td>The existence of an abnormal condition on or near the tracks which could impair safe train movement.</td>
</tr>
<tr>
<td>Road Call</td>
<td>Dispatching vehicle maintenance personnel with or without a replacement bus to a bus on the road that has had a mechanical failure or accident.</td>
</tr>
<tr>
<td>Route</td>
<td>A predefined path through the service area for which timepoints, bus stops, and a schedule are defined.</td>
</tr>
<tr>
<td>Run</td>
<td>A pre-defined daily work assignment for an Operator.</td>
</tr>
<tr>
<td>Running Time</td>
<td>The schedule time period for a revenue vehicle to operate between successive timepoints.</td>
</tr>
<tr>
<td>SAE J1587</td>
<td>A Society of Automotive Engineers standard for data interchanges between microcomputer systems in heavy-duty vehicle applications. It defines the format of messages, field descriptions, size, scale, internal data representation, and position within a message used to communicate on a vehicle area network. It also provides the frequency and circumstances in which a message is transmitted.</td>
</tr>
<tr>
<td>SAE J1708</td>
<td>A Society of Automotive Engineers standard for serial data communications between microcomputer systems in heavy-duty vehicle applications. It describes those parameters of a serial link that relate to electrical characteristics and hardware timing. It is used in conjunction with J1587 to define vehicle area network communications.</td>
</tr>
<tr>
<td>SAE J1939</td>
<td>A Society of Automotive Engineers standard used for communication and diagnostics among vehicle components, particularly the engine control units, and widely adopted by diesel engine manufacturers.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Safety-critical</td>
<td>Safety-critical, as applied to a function, a system, or any portion thereof, means the correct performance of which is essential to safety of personnel or equipment, or both; or the incorrect performance of which could cause a hazardous condition, or allow a hazardous condition which was intended to be prevented by the function or system to exist. A term applied to a system or function, the correct performance of which is critical to safety of personnel and/or equipment; also a term applied to a system or function, the incorrect performance of which may result in an unacceptable risk of a hazard.</td>
</tr>
<tr>
<td>Safety Validation</td>
<td>A structured and managed set of activities, including analysis and test, which show that the system, as specified and implemented, performs the intended functions and that those functions result in overall safe operation. Validation answers the question, “Did we build the right system?”</td>
</tr>
<tr>
<td>Safety Verification</td>
<td>A structured and managed set of activities, including analysis and test, which show that the system, including its subsystems, interfaces and components, as designed and implemented, meets the allocated system safety goals and requirements.</td>
</tr>
<tr>
<td>Schedule</td>
<td>A list of planned arrival and/or departure times for each timepoint on a route, over a fixed period of time such as a 24-hour day or portion thereof, along with associated information such as the route and time point names.</td>
</tr>
<tr>
<td>Screen</td>
<td>The full physical display area of a monitor or other display device.</td>
</tr>
<tr>
<td>Service Monitors</td>
<td>SEPTA personnel assigned to monitor bus service throughout the service area.</td>
</tr>
<tr>
<td>Supervisors</td>
<td>Personnel assigned to monitor bus operations throughout the service area. Supervisors generally are located in the field operating from non-revenue support vehicles.</td>
</tr>
<tr>
<td>System</td>
<td>When used alone as a proper noun shall refer to the SEPTA CARD System. When &quot;system&quot; is used alone as a common noun, it shall refer to the specific assemblage of equipment and circuitry under discussion.</td>
</tr>
<tr>
<td>System Administrator</td>
<td>A privileged user who is ultimately responsible for overall administration and maintenance of the CARD System, and for controlling access to the system by all other users.</td>
</tr>
<tr>
<td>Timepoint</td>
<td>A location on a route assigned a scheduled arrival and/or departure times.</td>
</tr>
<tr>
<td>Timetable</td>
<td>A tabulation of the times that vehicles are expected to be at certain locations based upon a feasible operating schedule, with time measured by the master clock.</td>
</tr>
</tbody>
</table>
Transfer 1.) A passenger getting off one transit vehicle and getting onto another; 2.) A slip of paper denoting proof of cash or ticket payment that is honored on another trip or route.

Transit Center A facility for transfers, typically with assigned berthing locations for buses and shelter(s) for passengers.

Trip One-way movement of a revenue vehicle from start to end terminus locations.

Tripper Short-duration supplemental vehicle movement, typically operating during peak operating periods.

Turn-back Revenue vehicle that skips the remaining portion of a trip and begins a subsequent trip at a point other than the terminus location.

User-adjustable Modifiable by authorized CARD System users via workstation displays normally accessible to those users.

Vehicle Control Head A display device (VCH) with integrated or separate computer processing capabilities (IVCU) that is used on-board revenue and non-revenue vehicles.

Vehicle ID Unique numeric designation assigned to each revenue and nonrevenue vehicle.

Vehicle Operator A generic term used to refer to the operator/driver of a vehicle.

Wildcat shuttle Supplemental transit service

Workstation A computer platform, typically a networked personal computer, having one or more monitors, a mouse and keyboard, and associated operating system and CARD System application software.

Workstation Position A seated location where a CARD System user performs their duties. Workstation positions typically consist of a computer, communications equipment, and other ancillary equipment. Workstation positions may or may not have console furniture.

Window A defined display area on a screen.

PART 2 – PRODUCTS – NOT APPLICABLE TO THIS SECTION

PART 3 – EXECUTION – NOT APPLICABLE TO THIS SECTION

END OF SECTION
SECTION 01200

PROJECT MEETINGS

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies the criteria and procedures for the project meetings.

B. To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the SEPTA Project Manager will conduct project meetings throughout the project design, development, construction, testing, and cutover periods.

C. The project meetings are in addition to other meetings noted elsewhere in the Contract Documents.

1.02 QUALITY ASSURANCE

A. One of the persons designated by the Contractor to attend and participate in the project meetings shall have all required authority to commit the Contractor to solutions agreed upon in the project meetings.

1.03 PROCEDURES

A. Agenda Items

1. The Contractor shall submit an agenda for all meetings seven (7) calendar days in advance, which includes date, time, location, and items for discussion. In addition, Progress meetings shall incorporate, design, implementation, and construction issues, schedule, and Contract issues.

2. To the maximum extent practicable, advise the SEPTA Project Manager at least 48 hours in advance of project meetings regarding all items to be added to the agenda.

B. Meeting Minutes and Action Items

1. The Contractor shall compile meeting minutes of each meeting and make available meeting minutes following each meeting via the SEPTA electronic PMIS (Project Management Information System). within 7 calendar days of the meeting.

2. Contractor shall be required to receive and exchange information regarding meeting minutes in SEPTA’s electronic PMIS environment.

3. The Contractor shall prepare, maintain and update of all project action items. The Action item list shall include all pertinent information on each action item, including: description of the action item, responsible company and individual, date the action item was opened and closed, action item status (open, closed, cancelled, on-hold, etc.)
4. Meeting minutes shall be contained within the e-Builder calendar.

1.04 MEETING SCHEDULE

A. Project meetings shall be in accordance with a schedule prepared by the SEPTA Project Manager which will be distributed to the Contractor prior to the first scheduled meeting.

B. The SEPTA Project Manager shall have the authority to call additional project meetings at any time.

C. Unless otherwise directed by the SEPTA Project Manager, Project Progress Meetings shall be held monthly throughout the project.

1.05 MEETING LOCATIONS

A. To the maximum extent practicable, meetings shall be held at the SEPTA offices on 1234 Market Street, Philadelphia, PA. Otherwise, site will be determined by the SEPTA Project Manager.

B. Progress meetings may be included with design review, factory testing, or other meetings organized in the development of the systems.

1.06 KICKOFF MEETING

A. A kickoff meeting shall be scheduled within ten (10) days after the Authority has issued the Notice to Proceed. The Contractor shall ensure the attendance by key Contractor personnel and authorized representatives of the Contractor's Sub-Contractors.

B. Minimum Agenda: Distribute data on, and discuss:

1. Organizational arrangement of Contractor's forces and personnel, and those of Sub-Contractors, materials suppliers, and SEPTA Project Manager, which includes an Organizational Chart and Contact List.

2. Channels and procedures for communications

3. Project office location and main contacts

4. Design, implementation, construction, testing and cutover schedule, including sequence of critical work

5. Interfacing with other Contractors

6. Submittal Procedures

7. Issues resolution procedures

8. Materials to be ordered

9. Equipment to be used
10. Processing of Shop Drawings and other data submitted to the SEPTA Project Manager for review
11. Rules and regulations governing performance of the Work, Safety training, etc.
12. Procedures for safety and first aid, security, quality control, housekeeping and other related matters
13. Methods for maintaining and protecting on-going Authority operations during construction

C. The Contractor and the SEPTA Project Manager will arrange for their authorized representatives to meet and review details of design and construction, and if appropriate, to walk the project with the Contractor and carefully observe all pertinent conditions relating to the design, execution, and construction of the Work.

1.07 MONTHLY PROJECT PROGRESS REPORTS

A. The Contractor shall prepare a progress report for each monthly reporting period. The report shall be made available to SEPTA at least one week prior to each progress meeting. The progress report shall include the following items:

1. An updated project schedule with explanations of any deviations from the planned delivery schedule

2. The explanations shall include the anticipated impact of any delays and a plan for returning to the target schedule. All delays shall be factored into the project schedule as soon as they are known to the Contractor. Also, all changes to the schedule since the last progress report shall be identified.

3. An updated list of all correspondence transmitted and received

4. An updated documentation status table showing the status of all documentation items and highlighting the documents to be transmitted for review during the next two reporting periods

5. A summary of activities performed by the Contractor and SEPTA during the previous reporting period

6. A summary of pending and upcoming Contractor and SEPTA activities during the next two reporting periods, along with required completion dates

7. The status of unresolved contract questions and change requests

8. A description of current and anticipated project problem areas and steps to be taken to resolve each problem.

1.08 PROJECT PROGRESS REVIEW MEETINGS
A. To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work. Attendance by the key, direct technical and financial reports to the Contractor Project Manager shall be mandatory. The SEPTA Project Manager may require the Contractor employees to attend meetings as directed. Sub-Contractors, materials suppliers, and other may be required to attend those project meetings in which their aspects of the work are involved.

B. Be prepared to discuss progress of the work in sufficient detail for both the Contractor and SEPTA to confidently control and monitor the prescribed work scope and schedule.

C. Prepare a bar chart for presentation at each meeting showing status of major phases of the work, delineating work that is behind schedule.

D. All meetings shall begin with a safety briefing.

E. Minimum Agenda

   1. Previous Meeting Minutes: Review, revise as necessary, and approve minutes of previous meeting.

   2. Review, discuss and update the latest monthly project progress report

   3. Progress of Work: Review progress of the work since last meeting, including status of submittals for approval. Review submittal schedules; expedite as required to maintain schedule.

   4. Financial status of the project.

   5. Open Issues: Identify problems which impede planned progress. Discuss technical issues and resolve or direct actions to be taken.

   6. Schedule: Discuss current project schedule and, when required, develop corrective measures and procedures to regain planned schedule, using the approved project schedule as the basis.

      a. Review changes proposed by SEPTA for:

         1) Effect on approved project Schedule

         2) Effect on project Completion date

   7. Projected work: Planned work for the next reporting period.

      a. This plan shall be accompanied by a written schedule of work proposed for the next reporting period.

      b. Coordinate projected progress with work by SEPTA and other Contractors, if applicable.

9. The status of Requests for Information (RFI) shall be discussed and updated.

10. New Action Items; assign responsible individuals and due dates.

F. The Contractor shall also attend technical meetings as required to discuss technical aspects of the project and to review comments on documents submitted for approval. When appropriate, these technical meetings may be conducted as extensions to the project progress review meetings.

G. Additional project meetings will be called for by the SEPTA Project Manager as necessary. The Contractor may request additional meetings to discuss special issues. The SEPTA Project Manager will review such requests and schedule a meeting if the SEPTA Project Manager considers it necessary.

H. Contractor shall have a meeting attendance sign in sheet which all attending will be required to sign to verify attendance.

I. Revisions to Minutes;

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

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

5. Challenge to minutes shall be settled as priority portion of “Previous Meeting Minutes” at the next regularly scheduled meeting. The SEPTA Project Manager’s decisions concerning challenged item(s) shall be binding on the Contractor.

1.09 MONTHLY PROGRESS REVIEW CONFERENCE CALLS

A. The Contractor shall participate in Monthly Progress Review conference calls with SEPTA representatives. These monthly conference calls shall be scheduled at a mutually agreeable time and date, approximately two (2) weeks after each monthly Project Progress Review Meeting during the full course of the project. The purpose of these conference calls shall be to maintain progress and continuity in between the monthly Project Progress Review Meetings and to discuss any technical, schedule, action item, deliverable, coordination, and project management issues that need to be resolved in order to help keep the project on schedule. Although these conference calls will be conducted informally, and both the Contractor and SEPTA may propose topics to be discussed during each call, a brief agenda shall be issued by the Contractor at least two (2) days prior to each conference call for review by SEPTA. A scheduled conference call may be canceled if both the Contractor and SEPTA agree to do so. Monthly Progress Review conference calls may also be combined with scheduled
design review or similar conference calls if both the Contractor and SEPTA agree to do so.

1.10 PARTNERSHIP WORKSHOP

A. This Project shall utilize the concept of partnering to promote cooperation, minimize confrontation, and resolve disputes amicably. Partnering is a voluntary, cooperative approach aimed at reducing costs, disputes, and litigation, and improving communications, project quality, and time of performance. The Contractor’s Project Manager for the Project shall arrange and sponsor a 1-day partnering workshop, including the provision of a professional facilitator, to develop a commitment to teamwork, identify mutual goals, and foster communications between the parties involved in this Project.

1. The workshop shall also establish issue resolution procedures, and implementation and evaluation plans for follow-through over the course of the project. Periodic evaluations of the partnering process and mutual commitments shall be scheduled at least annually during the project.

2. The Partnering Workshop shall be scheduled as soon as possible after the Notice To Proceed (NTP) is issued for the contract at a mutually agreed date and location, when all key participants are available, preferably within 60 days after the contract NTP.

PART 2 – PRODUCTS - NOT APPLICABLE

PART 3 – EXECUTION - NOT APPLICABLE

END OF SECTION
SECTION 01300

SUBMITTALS AND DESIGN REVIEWS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship, materials, and operability has been defined by manufacturer's name and/or catalog number, reference to recognized industry and government standards, or description of required attributes and performance.

B. To ensure that the specified products are furnished and installed in accordance with design intent; procedures have been established for advance submittal of design data for the SEPTA Project Manager’s approval.

C. Contractor shall provide all submittals required by the Contract Documents, or requested by the SEPTA Project Manager and revise and resubmit as required by the SEPTA Project Manager to establish compliance with the specified requirements.

D. The Contractor shall comply with the requirements of these specifications and with other provisions pertaining to submittals described in these Specifications.

E. In modifications to the requirements of the Agreement, all submissions shall be made to the SEPTA Project Manager with certain submittals forwarded to the Engineer for review prior to approval.

F. SEPTA reserves the right to investigate any of the Contractor's proprietary information or documentation. The Contractor shall cooperate with SEPTA by supplying appropriate documentation of proprietary information upon request. The Contractor shall have the right to request the SEPTA Project Manager and whoever will be reviewing the proprietary information to sign a Confidentiality Agreement before providing said documentation.

G. All submittals shall become the property of SEPTA. All submittals shall be made solely by the Contractor through the use of written correspondence describing the purpose of the submittal, the anticipated work and response by the Engineer and the specific identification of the material submitted in terms of drawing/revision numbers, document numbers, etc.

H. All written communications and submittals unless otherwise noted shall be in Word format on 8.5 inches wide by 11 inches high paper. Documents shall be appropriately bound to preclude lost pages while allowing ease of use without special preparation by the Engineer. Documents that can be classified as manuals, reports or analyses shall be fastened on the left side into a profile binder to allow convenient filing. The title of such documents shall appear on the front cover and shall appear on the spine of the binder if space permits. Electronic versions of
submittals and correspondence shall also be submitted in electronic format in Word.

I. Following the Notice to Proceed, the Contractor and the Engineer shall mutually agree on a common correspondence identification coding system. All correspondence shall be coded by the sender with a letter(s) from the English alphabet to designate the originator and with a unique sequence number to ensure unmistakable identity. All correspondence shall readily display the SEPTA purchase order number, denote if a reply is required, and the identity of coded correspondence being replied to, if any. Both parties shall maintain a log to list the date all correspondence is sent or received.

J. The documentation methodology, particularly as regards to the submission of drawing and engineering changes, shall be user friendly and allow for ease of comprehension and review to the Engineer's satisfaction. A standard format shall be used for documentation for the duration of the Contract. The Contractor shall organize the submissions in a logical, interrelated fashion such that functionally or physically associated subjects are submitted in concert.

K. The Contractor acknowledges that only drawings, documents, topics or other materials that have been thoroughly reviewed, considered specification compliant and/or are supported by the Contractor shall be communicated to SEPTA and to the Engineer to promote concentrated efforts on issues that will benefit and progress the project. To this end, all correspondence shall be retained for a minimum of five years to reduce, if not prevent, the needless iteration of work already completed.

L. Should the Contractor's drawings and schedules be inadequate in the opinion of the SEPTA Project Manager, SEPTA reserves the right to require the Contractor to supply the necessary additional drawings, details and schedules. After production baseline has been achieved, engineering or manufacturing change orders or deviations shall be submitted to the Engineer for approval as they are issued. SEPTA or designated representative(s) shall authorize the Contractor to proceed upon the written approval of drawings provided that the Contractor has notified SEPTA of all deviations. SEPTA approval, however, will not relieve the Contractor of his responsibility to fulfill his contractual obligations. SEPTA will supply written reasons and explanations for disapproval of any required submittals through the Engineer. Drawings and technical data submittals provided by the Contractor shall be in sequential order consistent with the schedule developed in the Design Reviews between the Contractor and SEPTA. The Contractor shall not patent or copyright any original materials or information created by this procurement which will be submitted to SEPTA, as per Federal procurement regulations.

M. The contractor is required to submit all information through the SEPTA PMIS.

N. SEPTA has a PMIS in place used for tracking key performance indicators (KPIs) through integrated reporting and dashboards populating capital project with 'real time' information essential for performance tracking and benchmarking which are essential to achieving SEPTA's project management goals.

O. The Contractor shall submit all project information/communication through SEPTA's CARD System 01300-8 Submittals March 2021
current PMIS. Contractor is required to coordinate with the SEPTA PM regarding hands-on training for contractor project employees on the SEPTA PMIS program (i.e. e-Builder). SEPTA will not compensate the Contractor or their personnel for any formal and/or informal training of contractor’s staff on the SEPTA PMIS.

P. Notifications and Distribution - Document distribution to project members shall be accomplished both within the PMIS (extranet) system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.

1.02 LANGUAGE

A. All written communications, submittals, reports, drawings, correspondence and oral communications to SEPTA shall be made in the English language, using technical terminology conventional to that used at SEPTA.

1.03 QUALITY ASSURANCE

A. Prior to each submittal, the Contractor shall carefully review and coordinate all aspects of each item being submitted and verify that each item and the submittal for it conforms in all respects with the requirements of the Contract Documents. The Contractor, by affixing the Contractor’s signature to each submittal, certifies that this coordination has been performed.

B. The Contractor shall determine and verify all pertinent data, interface conditions, catalog numbers, and similar data.

1.04 SUBSTITUTIONS

A. When submitting proposed substitutions as "Or Equal", include all pertinent data establishing the substitution’s operable history in similar configuration, operability, sustainability, reliability, safety, in similar system integration, quality, appearance, workmanship, design, and capacity. In addition, include other technical or operational data as may be required by SEPTA, including related information of proprietary product of manufacturer cited herein. All substitutions shall be approved by the SEPTA Project Manager whose decision shall be binding and final.

1.05 PROJECT SCHEDULE SUBMITTAL

A. The Contractor shall generate, maintain, and provide periodic updates to the CARD System project schedule. The CARD System project schedule shall identify all relevant project events from the Notice-To-Proceed through Final Acceptance and Warranty. The project schedule shall include, the payment milestones, Contractor activities, SEPTA activities, submittals, testing, and training. Planned and actual task start and end dates shall be shown along with task percentage completions and all dependencies between tasks. The critical path for the project shall be calculated and displayed.

B. The project schedule shall be an accurate and up-to-date representation of the progress and planned activities for the CARD System project. The Contractor shall
maintain the schedule using Microsoft Project. Schedule submittals to SEPTA shall be in PDF format but the project schedule Microsoft Project files (.mpp format) shall be provided to SEPTA upon request. All changes to the project schedule dates shall require approval by SEPTA.

1. The CARD System project schedule shall include all Contractor and subcontractor activities related to the project, including the following:

   a. SEPTA site survey(s)
   b. Preliminary Design and Review Meeting
   c. Final Design and Review Meeting
   d. Hardware purchases, development, and integration
   e. Documentation preparation and submittal to SEPTA, including CAD/AVL System site installation,
   f. Documentation revision and re-submittal following SEPTA comments
   g. Software design, coding, implementation, and integration
   h. System integration
   i. Training
   j. Progress Reports
   k. Meetings and conference calls
   l. Subcontractor contracts in place
   m. Pre-factory internal and dry-run testing
   n. Factory Acceptance Test, including variance resolution and retesting
   o. CAD/AVL System shipment to SEPTA
   p. Field Installation and Field Performance Tests
   q. Mini-Fleet Test
   r. Availability Test
   s. Final Acceptance
   t. Start and expiration of warranty.

2. The CARD System project schedule shall include all SEPTA activities required for the Contractor to complete the project, including the following:

   a. Contract Award
   b. PDR and FDR review and approval
   c. Document review and approval
   d. Data submittals
   e. Meetings and conference calls
   f. Training
   g. Factory Acceptance Test approval
   h. Field Installation and Performance Test approvals
   i. Mini-Fleet Test approval
   j. Availability Test approval
   k. Final Acceptance.

3. The CARD System project schedule shall include all CARD System documentation to be provided during the project. The project schedule shall assume a minimum of two review cycles (one for the initial issue and one for a revised version) of each document will be required prior to approval. Twenty working days shall be allotted in the schedule for the first SEPTA review of each
submitted document and ten working days shall be allotted in the schedule for subsequent reviews of a revised document. Working days are defined as Monday through Friday, excluding SEPTA holidays.

4. The CARD System project schedule shall include all CARD System training to be provided during the project. Scheduling of courses shall be coordinated with other activities in the project schedule and shall be subject to approval by SEPTA.

1.06 SUBMITTAL SCHEDULE

A. The Contractor shall compile a complete and comprehensive schedule of all submittals anticipated to be made during progress of the work. Include a list of each type of item for which Contractor's Drawings, Shop Drawings, Certificates of Compliance, guarantees, or other types of submittals are required. Provide schedule to the SEPTA Project Manager within 30 days after Notice to Proceed. Upon approval by the SEPTA Project Manager, the Contractor shall be required to adhere to the schedule unless specifically permitted by the SEPTA Project Manager.

B. Coordinate the submittal schedule with the design, implementation, construction and testing schedule to be submitted. Coordinate the schedule with all necessary Sub-Contractors and materials suppliers to ensure their understanding of the importance of adhering to the approved schedule and their ability to so adhere. Coordinate as required to ensure the grouping of submittals as described herein.

C. Revise and update the schedule on a monthly basis or more frequently as necessary to reflect conditions and sequences. Submit revised schedule promptly to the SEPTA Project Manager for review and comment.

1.07 GENERAL DOCUMENTATION REQUIREMENTS

A. All drawings generated in English dimensions need not have metric equivalents. The Contractor shall provide both metric and English dimensioning for his drawings and other communications which are generated in and use metric. Fractional measurements shall be expressed as a decimal value, and unless otherwise noted and approved drawings shall be made using third angle projections. First angle projection shall be allowed provided all views are labeled, including the front, top, bottom and side views. Within a vehicle subsystem, all dimensions shall be given in English or English plus metrics. There shall be no mixing of dimension systems on a drawing.

B. A standard format shall be used for documentation that is carried throughout the duration of the Contract.

1. Each document shall, as a minimum, contain the following:
   a. A title page with a clear and concise title block, which includes all pertinent references to the Contract and an accurate description of enclosed information.
   b. Display approval signatures of the original document on the title page to serve as an easy reminder of the approval signatures required for all future revisions.
   c. Display the SEPTA purchase order number on the title page.

CARD System 01300-11 Submittals March 2021
d. Display the originating company's name and address on the title page.

e. Display the overall revision level on the title page and display the varying revision level on each consecutive page.

f. Display the unique document number on each page of the document.

g. Record the specific changes of a revision on a dedicated page that includes space for new approval signatures for that revision without requiring the removal of previous approval signatures.

h. Record the revision levels of individual pages on a dedicated page for verification of proper document composition.

i. Contain a table of contents and an itemized listing of tables and figures.

2. Depending on the type document involved, additional provisions are stipulated in the applicable Sections.

3. Information in the form of foldouts shall not be used. Where information cannot be reduced to the required format size while maintaining legibility of important detail, it shall be divided or formatted appropriately to allow consistent and organized presentations. Except where voluminous information is involved, only one side of the paper shall be used. The use of both sides of the paper shall be restricted to text which allows graphical presentations to stand alone.

4. As a whole, all documents shall be organized in the order of the following general segments to allow immediate recognition of information as it pertains to the Contract and to the Technical Specification:


b. A summary, if applicable, of results and/or derived conclusions related to each individual provision where more than one is involved

c. Discussion, if applicable, of background information, assumptions and other factors necessary for the understanding of the information provided in the summary, or in the body of information that follows when a summary does not apply

d. The body of the document, which either contains the major and usually more extensive information that supports the summary or details the topics concerned

e. All appendices, providing either background information or a convenient collection of worksheets, drawings, and other reference material

1.08 DESIGN REVIEWS

A. The Contractor shall conduct two major technical project design reviews; a Preliminary Design Review (PDR) and a Final Design Review (FDR).

B. All submittals required for the PDR and FDR design reviews, plus an agenda and presentation material (i.e., slides), shall be received by SEPTA at least ten working
days prior to the design reviews. The PDR and FDR presentations and discussions shall be conducted at SEPTA facilities and are expected to be at least five days in length, but shall continue until all issues are resolved. The PDR and FDR shall not be considered successfully completed until SEPTA is satisfied that the design has progressed to the appropriate level and that there are no significant unresolved issues. If SEPTA determines the design has not reached the appropriate level for the PDR and/or FDR, or if there are significant design issues, the Contractor shall correct the inadequacies and submit revised documentation reflecting the corrections. Portions of the review meeting shall be repeated as required by SEPTA and no schedule relief shall be granted to the Contractor.

C. A Design Review Program is the design development and approval program which shall begin with a System Functional Analysis and include a Preliminary Design Review phase (PDR), a Final Design Review phase (FDR) and progress through First Article Inspections (FAI).

1. The Design Review Program shall include, but not be limited to, SEPTA review and approval of all the design concept and arrangement drawings of the equipment installations, all the engineering and production detail drawings, performance and design calculations, software designs, EMI evaluation, subsystem configuration drawings and design details, vehicle designs, and mock-ups as required.

a. The Contractor shall plan the Design Development process in two phases. The initial phase shall be designated the PDR phase and shall be a period during which the Contractor establishes all the basic physical and systems configurations of the equipment in general arrangement drawing form. Other forms of documentation may accompany these drawings.

b. PDR shall be followed by a FDR phase during which the Contractor shall develop all detailed working drawings and documents required for the manufacture of the equipment and development of the software.

2. Design Review activities shall also include review and approval of substitute or equal materials not dealt with in the pre-proposal period, and review and approval of the Contractor's test program and Quality Assurance program as well as all other Contractor management programs.

3. Design Review activities shall continue throughout the entire pre-production period, with each succeeding stage presenting greater amounts of detail and reflecting the progress of the designs.

4. In addition to the Contractor's own designs, the Contractor shall submit the design of all components being purchased by the Contractor or provided by subcontractors for review and discussion at the Design Review sessions. In all submissions and at all sessions the Contractor and supplier presentations shall be organized so as to show exactly how the design meets each specific requirement of the Technical Specification.

5. This Design Review program must be completed and all appropriate drawings
approved by the Engineer prior to the delivery of hardware and software. (Loss resulting from deviations from this principle are the responsibility of the Contractor. The approval of individual releases does not automatically entitle the Contractor to procure hardware.)

6. System Functional Analysis

a. Two (2) weeks after the Kickoff Meeting, a Specification Review Conference shall be held. One (1) week following the Specification Review, the Contractor shall submit to SEPTA for approval a CARD System Functional Analysis.

b. This CARD System Functional Analysis shall focus on all operational areas with human interface, and shall serve as a working and controlling document for all design activities. Updating of the system functional analysis shall be continual as the design is refined or changed through the Design Review process. It shall define and delineate the following:

1) All normal operating functions and activities.

2) Abnormal and failure based functions and activities, including troubleshooting.

c. The intent of the system functional analysis shall be to establish exactly how an activity is to be carried out, i.e., what the operating condition requiring action is, what the human inputs will be, how the system will process the inputs, how the SEPTA CARD system will interface and react, and what the final response is to be, both to the user and to vehicle equipment.

d. Design criteria for the hardware and operational procedures for the user shall be developed, based upon the Technical Specification requirements and meetings with the Engineer.

e. Both the Contractor and any system supplier are anticipated to be involved in certain areas critical for design and human factors. Procedural information shall be the basis for future generation of supporting documents, such as the Operator's Manual.

f. The system Functional Analysis document shall contain text, schematics, logic flow diagrams, etc. as appropriate for the relevant subject, shall be formatted for ease of use and reference on a functional basis and shall be kept current by the Contractor with a minimum of time lag, not to exceed 30 days from the date of a change requiring revision.

7. Preliminary Design Review (PDR)

a. After approval of the CARD System Functional Analysis, the Preliminary Design Review process shall commence. This shall be conducted incrementally with SEPTA to evaluate the progress and specification compliance of the selected design approaches and their compatibility with the performance and other requirements of the Technical Specification.
b. PDR submissions shall be in a format that clearly informs or illustrates how the specification requirements are being met. Submissions which are judged to give evidence of unsatisfactory design, random or haphazard assembly or require SEPTA to discover what the Contractor is doing will be returned to the Contractor as disapproved.

d. During the PDR phase the Contractor shall prepare and issue to SEPTA as advance information a complete series of PDR arrangement drawings of the proposed system design a minimum of seven (7) days prior to the first review meeting, which shall be the subject of the first series of PDR meetings.

e. For the PDR, the Contractor shall present the design approach for the CAD/AVL System and all major subsystems, including room space layout, total system functional description, software system overview and preliminary design, workstation position layout, computer system configuration, communications interfaces, vehicle equipment designs and functions, external system interfaces, and implementation approaches for future hardware and functions described in the Technical Specification. All major subcontractors shall attend the presentation. The submittals that shall be provided for the PDR to support the design approach are as follows:

   
   i. System Functional Description

   ii. Hardware configuration block diagrams showing all CAD/AVL System equipment, including interfaces to other SEPTA systems and equipment

   iii. Data communications design, including communications between the CAD/AVL System and the wide area wireless data communications provider

   iv. Radio communications design, including communications between the CAD/AVL System and the radio system

   v. Layout plans for all equipment locations showing the dimensions and locations of the CAD/AVL System equipment

   vi. Workstation layout drawings showing the dimensions and locations of all Contractor and SEPTA-furnished equipment being installed at SEPTA

   vii. Custom Hardware Design documents

   viii. Draft Fixed-route Dispatcher Manual that describes the layout and content of all CAD/AVL System displays and reports and the user actions required to perform each function available to the Dispatchers

   ix. Training Course List including the title of each course, a list of topics covered, duration, prerequisites, and training site(s)
x. Draft Installation and Cutover Plan

xi. Interface Control Document(s).

f. After the PDR phase has been progressed to the satisfaction of SEPTA, a FDR phase shall be undertaken by the Contractor during which it develops detailed documentation and working drawings for all hardware and software based on the designs defined during the PDR. The FDR shall include an update of all of the design activity to date. All major subcontractors shall attend the meeting. Approval of the FDR and associated documentation will allow the coding effort, integration, and other final designs to be formalized and completed. Any unapproved design and implementation efforts conducted before the approval of the FDR shall be at the Contractor’s own risk. In addition to the submission of previous documentation, updated to reflect the results of any design changes since the PDR, the submittals shall include the following:

i. Detailed plans and schedule for the installation and commissioning of the CARD System, including parallel operation procedures

ii. Copies of each System report

iii. Color copies of all System displays

iv. Database Documentation

v. Confirmation of executed contracts with all major subcontractors.

9. First Article Inspection

a. The Contractor’s Quality Assurance program shall include a procedure for conducting First Article Inspections (FAI). Successful conduct of an FAI shall precede any shipment of material by an equipment supplier.

b. FAIs shall be conducted on all parts or assemblies as reflected within the different levels of drawings and prints and/or schematics. All parts and assemblies manufactured by subcontractors shall also have an FAI performed.

c. The FAIs shall occur not more than 12 months following the Contract NTP.

d. The procedure shall include the following requirements as a minimum:

1) A tracking system shall be developed and maintained which will identify each FAI subject and accurately reflect the present status of each inspection.

2) FAIs shall be performed on an actual sample considered to be complete by the manufacturer and reflecting the approved baseline drawings. The
successful completion of Engineering qualification tests for hardware and software (see Sections 13591 and 13592) for the system(s), as a prerequisite for conducting the FAI.

3) The FAI shall be performed using the approved baseline drawings in conjunction with the Technical Specification reflecting specific requirements of the subject along with any special tools, software and/or equipment needed to verify the design requirements, configuration and operation (if applicable) of the item being inspected.

4) All technical data required for maintenance manual and or parts catalogs shall be submitted as initial drafts in authoring file (MSWORD) and PDF file formats per this document prior to the full acceptance of the FAI. The initial drafts shall contain enough information to adequately maintain the equipment.

5) SEPTA shall be given notice of an upcoming FAI at least two weeks before its schedule date.

1.09 CONTRACTOR'S DRAWINGS

A. Drawings

1. Within 90 days from Notice to Proceed, the Contractor and the Engineer shall jointly agree upon a drawing numbering system not conflicting with other SEPTA drawings to be used for this Contract. All drawing titles shall give full names without punctuation or abbreviations and should use simple key words to aid in searching. Revision levels should be in letters, not numbers, starting with "A". Complete and dimensioned general arrangement drawings for each vehicle type shall be included.

2. All drawings submitted to SEPTA for review shall be in dwg/dxf format and shall be reproducible into high quality blue or black-line prints with sharp lines and white backgrounds. Drawings shall be prepared in accordance with ANSI Y14 drawing standards. Individual sheets with a maximum size of 3 feet 8 inches wide by 2 feet 10 inches high shall be used, unless otherwise approved by SEPTA. All drawings shall conform to the SEPTA drawing standards.

3. If any drawing is made obsolete during the length of the Contract, it shall be so listed and identified, along with the identity of any superseding drawing number. The Contractor shall provide SEPTA with all drawings which have been CAD generated conforming to the SEPTA AutoCAD standards provided as part of this specification.

4. The Contractor's Drawings shall show the general arrangement and such details as are necessary to provide a comprehensive description and depiction of the work to be performed for the SEPTA CARD project.

5. All drawings shall be provided with a “revision block” that shall contain, as a minimum, the initials of the draftsman, designer and checker of the drawing, an
area to briefly describe the changes, as well as the number of the revision and date that the revision was checked. When the changes are placed in service, this date shall be changed to the in-service date.

6. Furnish detail drawings for any temporary or demonstration work and methods of construction proposed for use. Take responsibility for such drawings and for the safe and successful construction of the work.

7. All working drawings and diagrams shall be developed utilizing AutoCAD 2018 format with National Micrographics and SEPTA standards. CAD disks and any cell libraries, special text or “blocks” used to create the drawings shall be submitted and remain the property of SEPTA.

B. Shop and Working Drawings

1. Definition - Shop Drawings:

   a. Shop Drawings consist of design, fabrication, erection, and installation drawings, schedule drawings, manufacturer's scale drawings, wiring and control diagrams, cuts of entire catalogs, pamphlets, descriptive literature and performance and test data.

2. Definition - Working (or Design) Drawings:

   a. Working Drawings consist of plans for temporary work, demonstration work and for other such work as may be required for construction but which does not become an integral part of the completed project. They should be accompanied by calculations or other sufficient information to completely explain the structure or system described and its intended manner of use and stamped by an Engineer registered in the Commonwealth of Pennsylvania.

3. Submit three (3) reproducible and ten (10) legible black line prints of all complete and detailed Shop and Working Drawings to the SEPTA Project Manager for review and approval.

4. Scale and measurements: Make all Shop Drawings and Working Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item or facility and method of installation or connection to the Work.

5. Prepare such Working and Shop Drawings as are necessary to adequately perform the Work and document the installation for SEPTA's future maintenance and operations.

   a. Prepare all shop drawings on sheets measuring 11 inches by 17 inches. The title block should display the following:

      1) Contract Number and Name
      2) Number and Title of the Drawing
      3) Date of Drawing or Revision
4) Name of Contractor and Subcontractor submitting drawing
5) Clear identification of contents and location of work
6) Specification Article Number

b. Name, Pennsylvania State Registration No., and seal of Professional Engineer certifying the drawing for all work and shop drawings as well as circuit design drawings shall be on a case by case basis as determined by the SEPTA Project Manager. Test plans, descriptive literature, catalog cuts and manuals may not be required to be sealed by a Professional Engineer unless the content of the document affects the safety of the traveling public, Authority employees, or others as determined by the SEPTA Project Manager.

6. Accurately and distinctly indicate the following:

a. All working and construction dimensions

b. Arrangements and sectional views

c. Necessary details, including complete information for making connections between sub-systems under this Contract.

d. Kinds of materials and finishes

e. Parts numbers and descriptions of products

f. On drawings for mechanical and electrical equipment, present where applicable, such data as dimensions, weight and performance characteristics. Show conformance with the performance characteristics and other data incorporated in the Contract Drawing and Specifications.

7. Distribution of submitted shop and working drawings shall be as designated by the SEPTA Project Manager. SEPTA Project Manager’s review comments will be shown on a reproducible copy when it is returned to the Contractor. The Contractor shall make and distribute all copies required for his purpose.

C. Control Center and equipment room drawings shall include cable runs and wire termination points and the wiring of all cabinets, racks, electrical panel, and house cables. These drawings shall be submitted to and approved by SEPTA prior to any installation.

D. Submit documentation and drawings for approval by the SEPTA Project Manager prior to procurement. All submittals shall reference applicable Specification Sections. Each submittal with multiple subsystems shall include a complete working system and include all sub-system documentation and drawings necessary for a complete system evaluation. No partial submittals of a system shall be accepted unless all sub-system documentation and drawings are included.

1. Manufactured Products: Furnish technical description and specifications of all products manufactured by the CARD system supplier which are proposed to be furnished to this Project.
2. Procured Products / Systems: Furnish the following information for those products and/or systems which will be procured from another source:
   a. Manufacturer
   b. Generic description, model name and number
   c. Technical Specifications
   d. Safety Certificates and Statements of Compliance
   e. Representative samples of provided User Interfaces
   f. Sample Data Entry Screens
   g. Database formats
   h. Configuration and Management Requirements

3. When substituting manufactured or procured products, material different than shown on the drawings, the Contractor shall specify at the time of product submittal, on an item-by-item basis, the intended usage.

4. The Contractor shall submit a parts list detailing a comprehensive parts catalog and reference system. This list shall be a tabulation of all replacement parts for all equipment supplied under this Contract which is necessary to maintain the system. The Contractor shall recommend quantity of spares, current pricing, and ordering information as specified below.

   a. This data shall include in addition to the Contractor's part number, the manufacturer's part number and the name and address of the manufacturer. The parts list and manufacturing data to be supplied by the Contractor shall be reproducible in character and have a minimum size of 8-1/2” x 11”.

5. Detailed documentation on all communications interfaces, protocol and message structures.

   I. Final Documentation: Before final acceptance of all work to be accomplished under this Contract, the Contractor shall submit to the SEPTA Project Manager as- built drawings, shop drawings, schematic drawings, software programs, database files, configuration files, Compliers, parts lists, maintenance manuals, and product literature. All project correspondence including test procedures, reports, analysis, submittals, and letters shall be submitted on an adequately sized portable memory storage device or by other SEPTA-approved methods such as uploading the documents to the PMIS.

1.10 CERTIFICATES OF COMPLIANCE

   A. Submit to the SEPTA Project Manager all Certificates of Compliance for material approval prior to installation of materials as follows:

   CARD System 01300-20 Submittals
   March 2021
1. Certify that all materials used in the Work comply with all specified provisions thereof. Certification shall not be construed as relieving the Contractor from furnishing satisfactory materials if, after tests are performed on selected samples, by the Contractor or by the SEPTA Project Manager, the material is found to not meet specified requirements.

2. Show on each certification the name and location of the Work, name and address of Contractor, quantity and date or dates of shipment or delivery to which the certificate applies, and name of the manufacturing or fabricating company. Certification shall be in the form of letter or company-standard forms containing all required data. Certificates shall be signed by an officer of the manufacturing or fabricating company and shall bear the Contractor's approval stamp.

3. In addition to the above information, all laboratory test reports submitted with Certificates of Compliance shall show the date or dates of testing, the specified requirements for which testing was performed, the results of the test or tests, and shall be signed by the Technician/Engineer performing the tests.

1.11 MANUFACTURER'S LITERATURE

A. Where submitted literature from manufacturers includes data not pertinent to the submittal, clearly indicate which portion of the submittal is being submitted for review.

B. Three (3) copies of manufacturer's literature shall be required to be submitted to the SEPTA Project Manager. Prefer electronic copies submitted on USB sticks or by other SEPTA-approved methods such as uploading the submittals to the project PMIS.

C. Review procedures will be as specified in Article 1.16 “SEPTA Project Manager's Review.” One copy of submitted data will be returned. Where product data is required to be resubmitted, the Contractor shall promptly resubmit, within 10 days, 10 copies meeting Contract requirements.

1.12 DOCUMENTATION SUBMITTALS

A. Submit documentation such as certificates, reports, test results, delivery tickets, etc., as specified in the various Sections of these specifications to the SEPTA Project Manager.

B. Submit 10 copies of each of the various items required. Prefer electronic copies submitted on USB sticks or by other SEPTA-approved methods such as uploading the submittals to the PMIS.

1.13 IDENTIFICATION OF SUBMITTALS

A. Consecutively number all submittals. Accompany each submittal with a letter of transmittal containing all pertinent information required for identification and checking of submittals.
B. Transmittal Form

1. At the Project Kickoff meeting, the Contractor shall submit his proposed transmittal form to the SEPTA Project Manager for review and approval.

C. Submittals

1. Each submittal shall include as a minimum the following information:
   a. Submittal number
   b. Specification Section and Reference Paragraph
   c. Type of Submittal
   d. Description
   e. Schedule Submit Date
   f. Latest Date when Approval is needed
   g. Remarks

D. Re-submittals

1. When material is resubmitted for any reason, transmit under a new letter of transmittal. All re-submittals shall carry the same submittal number as the original submittal except an appendage ".1," ".2," ".3," etc. shall be added to indicate that the material is a first, second, third, etc., submission. For example, submission 177 would indicate an original submission; 177.1, a second submission; and 177.2, etc.

E. Submittal Log

1. The Contractor shall maintain an accurate submittal log for the duration of the Contract, showing current status of all submittals. Make the submittal log available for the SEPTA Project Manager’s review upon request.

1.14 COORDINATION OF SUBMITTALS

A. General

1. Prior to submittal for approval, use all means necessary to fully coordinate all material including, but not necessarily limited to:
   a. Determine and verify all interface conditions, catalog numbers, and similar data.
   b. Coordinate with other trades as required.
   c. Clearly indicate all deviations from requirements of the Contract Documents.

B. Grouping of Submittals
1. Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents and the Contractor shall be strictly liable for all occasioned delays.

C. Submittal Organization

1. All catalog cuts, certificates of compliance, and manufacturers' literature shall be grouped together, categorized in a logical sequence and submitted within three-ring binders. In the front of the binder an updated submittal log shall be provided showing the current status of all project submissions.

1.15 TIMING OF SUBMITTALS

A. Make all submittals in accordance with the approved Submittal Schedule and far enough in advance of scheduled dates for installation to provide sufficient time required for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery.

B. SEPTA Project Manager's Review Time

1. In scheduling, allow thirty (30) calendar days for review by the SEPTA Project Manager following his receipt of the submittal. The SEPTA Project Manager will stamp all submittals "Received," and the date so stamped shall be the official receipt date.

C. Delays

1. Delays caused by tardiness in receipt of submittals shall not be an acceptable basis for extension of the Contract Completion Date.

D. The Contractor's failure to submit the CPM plan/schedules and value line breakdown as required shall result in the withholding of progress payments until such submission requirements are met. No payment shall be made for any Item of work until the CPM plan/schedules and value line breakdown have been approved by SEPTA.

1.16 SEPTA PROJECT MANAGER'S REVIEW

A. The SEPTA Project Manager's review of drawings and schedules will be for conformance with the design concept only and should not be construed:

1. As permitting any departure from the Contract requirements

2. As offering relief from the responsibility for any errors, including details, dimensions, and materials

3. As approving departures from details furnished by the SEPTA Project Manager except as otherwise provided herein.
B. If drawings show variations from the Contract requirements because of standard shop practice or for other reasons, describe such variations in the letter of transmittal. If these variations result in a change to the Work Scope such that an adjustment to the Contract price or time for performance is necessary, proceed in accordance with the requirements specified in the Agreement. Failure to describe such variations shall not offer relief from the responsibility for executing the work in accordance with the Contract, even though such drawings have been reviewed.

C. Submittals reviewed by the SEPTA Project Manager and returned to the Contractor will be marked with one of the following designations:

1. No Exceptions Taken
2. Approved as Noted
3. Revise as Noted and Resubmit
4. Rejected - Resubmit
5. Review not Required

D. The Contractor shall not proceed with procurement, manufacture or fabrication of items submitted for review, until such submittals have been designated by the SEPTA Project Manager as "No Exceptions Taken" or "Approved as Noted," unless specifically authorized to do so by the SEPTA Project Manager.

E. Submittals to be Re-submitted

1. If corrections to the submittals are required, returned copies shall be marked "Revise as Noted and Resubmit," the required corrections shall be shown. One reproducible copy will be returned to the Contractor for corrections.

2. The Contractor shall resubmit the corrected material in the same quantity within ten (10) days after receipt by the Contractor of the disapproved material.

3. Resubmissions will be handled in the same manner as first submissions. On re-submittals, direct specific attention to revisions other than the corrections requested by the SEPTA Project Manager on previous submittals.

4. The Contractor shall promptly notify the SEPTA Project Manager, if any correction indicated on submittals constitutes a change of the Contract requirements.

5. Work indicated on submittals marked "Proceed as Noted" may be carried out prior to resubmission and final review.

F. Submittals Designated as "No Exceptions Taken"

1. Each copy of the submittal so designated by the SEPTA Project Manager will be identified accordingly by being so stamped and dated.

2. One reproducible copy will be returned to the Contractor.

3. When a submittal has been designated as "No Exceptions Taken" or "Approved as
Noted" by the SEPTA Project Manager, construction may proceed, notes to be adhered to, and no further changes made therein except upon written instructions from the SEPTA Project Manager. Final drawings shall be submitted to the SEPTA Project Manager.

G. Reimbursement of SEPTA’s Costs

1. In the event any Contractor's submittal is rejected twice for the same reason and must be submitted a third time, the SEPTA Project Manager and Engineer will record all time used by its staff, and Sub-Consultants in evaluation of third or subsequent submittals.

2. SEPTA will deduct such costs from the Contract Price through change order procedures and other means as established in the Contract.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION – NOT APPLICABLE

END OF SECTION
SECTION 01400
QUALITY CONTROL AND WARRANTY REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The Contractor shall provide and be responsible for a Quality Control (QC) Program to perform quality control, inspections and tests, and retesting in the event of failure of any item of work, including that of Sub-Contractors, to assure compliance with Contract provisions. The QC Program shall be submitted for approval of the SEPTA Project Manager and review of the Engineer. Quality control shall be established for all work. The QC Program shall include, but not be limited to; the inspections, tests, and validation required in the technical provisions of the Contract Specifications and shall cover all design, implementation, documentation, construction, and testing operations, including onsite and offsite fabrication.

1. General: Required inspection, testing, and validation services are intended to assist in determination of complete compliance of the work.

2. Definitions: Contractor QC services include inspections and tests and related actions including reports performed by independent agencies and governing authorities, as well as directly by the Contractor. These services do not include Contract enforcement activities performed directly by the Contractor’s Project Manager.

   a. Specific quality control requirements for individual units of work are specified in the sections of these specifications that specify the individual element of the work. These requirements include the inspections and test, and also cover quality control of the design and installation procedures.

   b. Inspections, tests and related actions specified in this Section and elsewhere in the Contract Documents are not intended to limit the Contractor’s own quality control procedures which facilitate overall compliance with requirements of the Contract Documents.

   c. Requirements for the Contractor to provide quality control services as required by SEPTA, governing authorities or other authorized entities are not limited by the provisions of this Section.

B. The Contractor’s Project Manager shall provide the duties of the Quality Control Representative. The Project Manager shall be provided with complete authority to take any action and make any commitment necessary to ensure conformance with the Contract including the authority to direct removal and replacement of any defective work or person.
1.02 PLAN

A. The Contractor’s Project Manager shall develop and submit to SEPTA for approval a Quality Assurance Plan for the Contractor and those of all major Sub-Contractors and Suppliers at the time of the Preliminary Design Review. The plan shall illustrate how the Contractor intends to meet the quality assurance requirements of this Technical Specification and shall include as a minimum:

1. An organizational chart, including a definition of the responsibilities of personnel thereon, for receiving inspection, defect material handling (especially related to material found malfunctioning during production conformance testing), production conformance testing verification, process specification implementation, equipment calibrations, etc.

2. The methods and procedures used to control the daily manufacturing processes and material quality.

3. The Contractor shall describe the hardware and software configuration management and control practices to be employed on the project to ensure and maintain system safety. This description shall include the Contractor’s notification process for any required hardware/software revisions, and shall highlight the roles and responsibilities of SEPTA in the configuration management process.

4. Flow charts of paperwork for the acceptance or rejection of material, for identification and disposition of unacceptable items resulting from inspections, for the specific accountability of material found malfunctioning during production conformance testing, for configuration verification of the constituent vehicle items to be included in the Vehicle History Book, etc.

5. Forms to be used to convey, track and account for design changes implemented in the sub-systems regardless of their state of completion and any other forms necessary for the program. Each form shall be serial numbered.

B. The Quality Assurance plan shall have a live document status. Any and all changes must be submitted to SEPTA during the next monthly progress report covering the time period the change took place. Changes affecting the project shall be subject to approval by SEPTA Project Manager. Lack of notification or changes deemed compromising the intent of the Technical Specification shall be cause to revoke the approval status of the plan.

1.03 REPORTS

A. The Contractor shall submit a report at least every 45 days to SEPTA that shall document the results of audits made within the Contractor’s, Sub-Contractors’ and Suppliers’ quality assurance functions; identify unsatisfactory conditions encountered with the design or equipment during its manufacture and/or installation; itemize all Field Modification Instructions (FMI) with a status of their incorporation and cross-referenced to the related Engineering Change Notice (ECN); and identify material part numbers, part designations (if any), serial numbers, configurations and descriptions that were found malfunctioning during production conformance testing. The list shall be
cumulative in nature, but shall communicate discernible trends in the increase, stabilization or reduction of conditions encountered. In the case of vehicle equipment, the vehicle number shall be used as a primary means of identification of summary lists of defects, if possible.

1.04 ORGANIZATION

A. The Contractor and his major Sub-Contractors and Suppliers shall establish a quality control program based upon MIL-I-45208A, adapted to the program in an approved manner or an approved equal. The organization of the Contractor's Quality Assurance (QA) Program shall have sufficient, well-defined responsibility and organization. It shall report directly to the General Manager of the Contractor's facility or the Contractor's Project Manager. In any case it must be completely independent of the Contractor's manufacturing or purchasing divisions. The QA personnel shall have complete freedom to identify and evaluate problems; to recommend solutions; to verify implementation of solutions; and to control further processing, delivery, or installation of a nonconforming or deficient item until proper and documented disposition has been obtained.

B. The QA organization shall be arranged to promote a control function that operates in an independent, objective manner unbiased by schedule, cost, and authority limitations imposed by personnel other than the Contractor's high level management starting with the General Manager or equivalent.

1.05 CERTIFICATION OF PERSONNEL

A. The Contractor's Quality Assurance personnel performing inspections and tests shall be certified for such work. Certification of personnel shall be by the virtue of those skills which are obtained by experience or training and verified by testing. Manufacturing personnel performing special processes, such as welding, brazing, etc., shall be certified for such work. Records of personnel certifications shall be maintained and monitored by the Contractor's Quality Assurance personnel. These records shall be made available to SEPTA for review.

1.06 EVIDENCE OF COMPLIANCE

A. The Contractor's QA personnel shall maintain objective, verifiable evidence of compliance with the Technical Specification as it pertains to hardware configuration, purchasing, inspecting, handling, assembling, fabricating, production conformance testing, storing, shipping and warranty/repair work in the interest of quality.
B. The Contractor may use certificates of compliance for certain materials and products in lieu of the specified sampling and testing procedures as approved by SEPTA for demonstrating proof of compliance of materials delivered to the work. Each shall clearly identify the lot so certified by the certificate and be signed by an authorized representative of the Supplier or Sub-Contractor, stating the material complies in all respects with the Contract requirements. Accompanying the certificate of compliance shall be a certified copy of test results or a statement that such test results are on file with the Supplier or Sub-Contractor, and shall be furnished to SEPTA on request. Each certificate shall contain the information specified for samples, the name and address of the organization performing the tests, the date of the tests and the quantity of materials shipped.

C. The Contractor shall demonstrate an effective time or usage cycled calibration program for testing of measurement equipment and tools. Validity of measurements and tests shall be ensured through the use of suitable inspection, measurement and test equipment of the range and type necessary to determine conformance of items with Contract requirements. At intervals established to ensure continued validity, measuring devices shall be verified or calibrated against certified standards that have a known traceable relationship to the US National Institute of Standards and Technology (NIST) or the local country's similar organization. Tooling used as a media of inspection shall be included in this program. Furthermore, every device so verified shall bear an indication attesting to the current status and showing the date (or other basis) on which inspection or recalibration is next required. Devices suspected of being out of calibration before the stated recalibration date shall be promptly recalibrated. Inspections performed with devices proven to be out of calibration must be re-inspected. All calibration certifications shall be recorded and become part of the Quality Assurance records.

D. The Contractor shall establish and maintain written procedures defining his Quality Assurance Program. The procedures shall encompass all phases of the program to include, but not be limited to, control of subcontractors, receiving inspection, production and process control, functional testing, discrepancy control, measuring and test equipment calibration, configuration control, quality assurance records, shipping inspection and other quality specifications to meet the requirements of the Contract. All such documents shall be made available to SEPTA upon request.

1.07 QUALITY ASSURANCE ACTIVITIES

A. The Contractor shall address, as a minimum, the following activities and shall provide a means of self-correcting any shortcomings in his Quality Assurance Program.

B. Procurement

1. The Contractor shall document in writing the methods to be used for the selection and control of suppliers. These methods shall identify a means of:
a. Selecting qualified procurement sources through the evaluation and assessment of their Quality Assurance programs

b. Communicating and approving all product quality requirements and changes thereof

c. Monitoring the Supplier's quality performance through the evaluation of procured items against purchase order requirements and through audits

d. Providing for early and effective information feedback and correction of non-conformances, especially of items found malfunctioning during production conformance testing

e. Approving special processes

2. The Contractor shall require each Supplier to be responsible for maintaining and retaining records. Furthermore, the Contractor shall require each Supplier, as a minimum, to submit with each shipment appropriate certifications, final inspection results and test results. Requirements shall be included for chemical or physical testing records in connection with the purchase of raw materials by the Sub-Contractors. The Contractor's purchase orders shall contain a requirement for the Supplier to notify and obtain approval from the Contractor of changes of design of the products which affect fit, form or function, or substitution of materials.

C. Manufacturing Inspection

1. Inspection shall occur at appropriate points in the manufacturing sequence to ensure quality consideration for compliance with drawings, test specifications, process specifications and quality standards. SEPTA may designate inspection hold points into the Contractor's manufacturing or inspection planning upon review of the Contractor's efforts. Inspection shall be 100 percent, or upon prior approval a statistical sampling plan may be used. Non-conforming materials shall be identified as discrepant and shall be segregated and reviewed for disposition.

D. Production Conformance Testing

1. The Contractor's Quality Assurance personnel shall witness the performance of all Production Conformance tests and verify proper configuration of the equipment tested. If any item does not satisfy all performance or design criteria, the item shall be retested until the tests are passed with the necessary adjustments or repairs documented and certified by a witness. In the case of sub-system and vehicle tests, a SEPTA Representative shall be included in this process and concurrence shall be obtained as a permanent part of the certification.
E. Receiving Inspection

1. The Contractor's receiving inspection activity shall provide for the inspection of all incoming materials. These inspection measures shall be used to preclude the use of incorrect or discrepant materials and to ensure that only correct and accepted items are used and installed. Upon prior approval from SEPTA, statistical sampling may be used. All material certifications and test reports used as the basis for acceptance by the Contractor shall be preserved. Inspection measures shall identify any item at any stage of production to an applicable drawing, specification or other pertinent technical document. Permanent physical identification shall be used to the maximum extent possible.

F. Shipping Inspection

1. The Contractor's Quality Assurance Program shall provide and enforce procedures for the proper inspection of all products to assure completion and conformance as required by the Contract prior to shipment. All shipments shall be prepared as required to preclude damage during shipment. The inspections and preparation for shipment shall be verified by the Contractor's Quality Control personnel. The authorization for the delivery of the vehicle shall be approved by SEPTA Project Manager.

G. Statistical Sampling

1. Statistical quality assurance sampling per ANSI/ASQC Z1.4 -1993 used in inspections shall be fully documented and based on generally recognized and accepted statistical quality assurance practices. Prior to the use of statistical sampling, the Contractor shall submit the proposed statistical sampling plan to SEPTA Project Manager for approval. Sampling plans may be used when tests are destructive, or when quality trend data, inherent characteristics of the product or the noncritical application of the product indicate that a reduction in testing or inspection can be achieved without jeopardizing quality. Any sampling plan used shall provide valid confidence and quality levels and shall be approved by SEPTA Project Manager.

H. Changes

1. The Contractor shall ensure that inspection and tests are based on the latest approved revision or change to drawings and specifications. A procedure shall be maintained that embraces the adequacy, completeness and updating of drawings, and the control of changes. This procedure shall be in coordination with the change control system as specified here-in. The Contractor shall ensure that requirements for the effectivity point of changes are met and that obsolete drawings and change requirements are promptly removed from all points of issue and use. Means of recording the effective points shall be employed and made available to SEPTA.
2. The Quality Assurance Program shall ensure that there is complete compliance with Contract requirements for proposing, approving and effecting engineering changes. The Contractor's responsibility for drawings and changes shall extend to what is provided by the Suppliers for the Contract.

I. Identification of Status
   1. The Contractor shall maintain a system for identifying the progressive inspection status of materials, components, sub-assemblies and assemblies as to their acceptance, rejection or non-inspection. The system shall provide for ensuring that required inspections and tests are performed and that the status of items with regard to inspections and test performance is known throughout manufacturing, installation and testing. Nonconforming items shall be identified by physical segregation and status indicators such as tags, serialization, markings, stamps and inspection records. The identification system shall ensure that only items that have passed the required inspection and tests are used or installed.

J. Handling
   1. The Contractor's Quality Assurance Program shall provide for adequate surveillance work and inspection instructions for the handling, storing, preserving, packaging, marking and shipping to protect the quality of products as required by the Contract.

K. Nonconformance
   1. The Contractor shall establish and maintain an effective and positive system for controlling nonconforming material and workmanship, including procedures for its identification, segregation and disposition. Dispositions allowing the use or repair of nonconforming material or workmanship shall require SEPTA Project Manager's approval. All nonconforming issues shall be positively identified to prevent unauthorized use, shipment or intermingling with conforming material. Holding areas and procedures mutually agreeable to the Contractor and SEPTA shall be established by the Contractor.

   2. Corrective action and related information shall be documented and made available to SEPTA upon request. Corrective action shall extend to the performance of all sub-suppliers and include as a minimum:

      a. Analysis of data and examination of discrepant products to determine extent and causes with corrective action implemented in an expeditious manner prior to the next shipment, order or inspection

      b. Introduction of required improvements and corrections, initial review of the adequacy of such measures, and monitoring of the effectiveness of corrective action taken
c. Analysis of trends in processes or performance of work to prevent nonconforming products

L. Quality Assurance Review

1. SEPTA shall review the Contractor's Quality Assurance Program and its functions at its discretion, to determine compliance with the approved Quality Assurance Plan. During its initial review, SEPTA shall inspect the various manufacturers', Sub-Contractors' and Suppliers' Quality Assurance functions. Subsequent examinations shall be performed by the Contractor for the same purpose. The Contractor shall be notified of all non-conformance determined during the review. Non-conformance with any part of the approved Quality Assurance Plan may be cause for rejection of the Contract work being performed by the responsible entity (i.e., if the Contractor is responsible, the work on the Contract may be rejected. If a Sub-Contractor or Supplier is responsible, the work by that Sub-Contractor or Supplier may be rejected).

2. Whenever SEPTA determines a non-conformance condition with the Quality Assurance Plan (whether in the Contractor's own plan, or that of its Sub-Contractors or Suppliers) the Contractor shall promptly correct the non-conformance and request approval by SEPTA Project Manager. Any schedule delays caused by non-conformance with the approved Quality Assurance Plan, whether on the part of the Contractor or its Sub-Contractors or Suppliers, shall not serve as a basis for an extension of the Contract time requirements.

3. Quality Assurance reviews of the Contractor's, Sub-Contractor's and Supplier's efforts shall be made by Contractor QA personnel and may be witnessed by SEPTA. As a minimum requirement, the reviews shall be made as a condition of a Sub-Contract or purchase order prior to the start of any work by a Sub-Contractor, and also within a 30 day period prior to the formal acceptance by the Contractor of the first article inspection or the services being supplied by the Sub-Contractor or Supplier.

4. The Contractor shall prepare a report for each review conducted by it and shall submit a copy to the inspected organization. SEPTA shall be informed of each review. The report shall describe the scope of the review, the procedures followed in conducting the review, a statement of all deficiencies found and keyed to the approved Quality Assurance Plan, the corrective action required for each deficiency found, and the date by which corrective action is required.

M. First Article Inspections

1. The Contractor's Quality Assurance program shall include a procedure for conducting First Article Inspections (FAI). Successful conduct of an FAI shall precede any shipment of material by a Sub-Contractor. FAIs shall be conducted on all parts, sub-assemblies and assemblies as reflected within the different levels of drawings and prints and/or schematics. All parts and assemblies manufactured by Sub-Contractors shall have an FAI performed. The procedure shall include the following requirements as a minimum:

a. A tracking system shall be developed and maintained which shall identify
each FAI subject and accurately reflect the present status of each inspection.

b. FAIs shall be performed on an actual sample considered to be complete by the manufacturer and reflecting the approved baseline drawings. Successful completion of engineering tests for the subsystem is a prerequisite for conducting the FAI.

c. The FAI shall be performed using the approved baseline drawings in conjunction with the Technical Specification reflecting specific requirements of the subject along with any special tools and/or equipment needed to verify the design requirements, configuration and operation (if applicable) of the item being inspected.

d. All technical data required for maintenance manuals and/or parts catalogs shall be submitted as initial drafts in authoring file and PDF file formats prior to the full acceptance of the FAI. The initial drafts shall contain enough information to adequately maintain the equipment during the Pilot program and initial vehicle retrofit.

e. SEPTA shall be given notice of an upcoming FAI at least two weeks before its schedule date.

1.08 INSPECTION OF WORK

A. Contractor Responsibilities

1. Inspections, tests, and similar quality control services shall be performed by the Contractor's organization or a qualified Contractor's representative that was not involved in the performance of the work under test.

2. The responsibility to see that the testing is performed in accordance with this specification rests solely on the Contractor. The costs for these services, whether they are performed by an independent agency or a Contractor's representative, shall be included in the Contract sum.

3. The Contractor shall submit all test and inspection procedures for approval by the SEPTA Project Manager. The Contractor shall employ and pay an independent agency, testing laboratory or other qualified firm, and/or engage an independent entity within the Contractor’s organization to perform quality control services if needed. The SEPTA Project Manager will review and approve this agency, laboratory or firm. The Contractor is required to develop an index of all required inspections and progress of QC inspections against this list.
B. SEPTA's Authority

1. SEPTA reserves the right, through the SEPTA Project Manager or his designated representative, to perform tests, inspection, or witnessing as appropriate to a QC program. These efforts are only as a check to verify the adequacy of the Contractor's QC program and in no way relieve the Contractor of his exclusive responsibility in ensuring the quality of all components of the completed construction.

C. Retest Responsibility

1. Where results of required inspections, tests or similar services, whether performed by the Contractor or not, prove unsatisfactory and do not indicate compliance with the Contract, then the cost of retesting is the responsibility of the Contractor, regardless of whether the original test was the Contractor's responsibility. Retesting of revised or replaced work is the Contractor's responsibility.

1.09 QUALITY CONTROL (QC) REQUIREMENTS

A. This Section contains the quality assurance and quality control requirements for this Contract. The Contractor's quality assurance efforts shall be in compliance with the requirements of the FTA Quality Assurance and Quality Control Guidelines document FTA-MA-06-0189-92-1 and ISO 9000 or ANSI/ISO/ASQC Q9000-1.

B. The Contractor shall plan and implement a QA Program to assure delivery of a quality product to the Authority under the terms of this Contract. The elements of the program shall be imposed on the Contractor's entire organization and all Sub-Contractors that perform Contract Work. The QA Program shall assure that all aspects of the Contract are in conformance with the design, materials and workmanship requirements provided in this Technical Specification and that those requirements shall be provided in a timely manner. The Program shall also require the Contractor to document inspection of the design and manufacturing operations.

C. Contractor Quality Assurance responsibilities required by this Technical Specification include planning, establishing and maintaining a Quality Assurance program; performing all work required by the quality assurance program; and conducting regular QA program audits.

D. The Contractor shall be solely responsible for all of the quality assurance functions required by this Contract. The Contractor shall assure Contract compliance by Sub-Contractors. Surveillance of Sub-Contractors shall include sampling and review of products, records, procedures, processes, manufacturing operations and quality control methods.
E. Each Section of this Specification includes the relevant quality requirements of that Section. The following are the general requirements for the Contractor that are found in the various Sections of this Specification:

1. Requirements for Quality Assurance (QA) and Quality Control (QC) program activities to be performed during the Contract

2. Requirements for a Contractor's Quality Control Plan and Quality Control Manager

3. General requirement for an Inspection and Test Plan

4. Requirements and qualifications for independent certified Material Testing Laboratories

5. Quality requirements for design control

6. Quality requirements for document control, including retention requirements

7. Quality requirements for purchasing, including requirements for Supplier quality assurance

8. Requirements for product identification and traceability

9. Quality requirements for process control

10. Quality requirements for inspection and test procedures control of measuring and test equipment, and tracking inspection and test status

11. Quality requirements for nonconformance and corrective action procedures, including nonconformance reporting requirements

12. Quality requirements for quality records, including logs, reports, and forms

13. Quality Audit requirements

14. Quality requirements for training

15. Requirements for the development and maintenance of Serialization Plans and Serial Number Data Bases

F. Engage a quality control organization, either an outside agency or an independent entity within the Contractor's organization, to develop a QC program and to perform inspections and tests of all items of work to ensure conformance with the Contract and to prepare consolidating reports summarizing the results of these tests and inspections and to certify the compliance of the work with the Contract requirements. The QC program
shall meet all the requirements of the latest revision of the American Society for Quality Control (ASQC) Standard ANSI/ASQC Q9001. The Contractor is required to keep up-to-date registration to this standard during the term of this Contract. The QC agency’s responsibilities shall include, but are not limited to, the inspections and tests required by the Contract for all construction activities, including both onsite and offsite fabrication and all tiers of Sub-Contractors. The Sub-Contractors themselves are not required to be registered under Q9001, but their own QC Program must be approved by SEPTA.

1. Specific equipment required to meet or exceed ANSI/ASQC Q9001 Quality standards shall be as follows:

   a. Vehicle
      1) SEPTA CARD System and peripheral components
      2) All internal system wiring and connectors
      3) All vehicle-body wiring and connectors
      4) Data Radio/Mobile Communication Package (MCP) components

   b. Control Center
      1) Servers
      2) Workstations
      3) Network Management System servers
      4) Communications Manager Hardware
      5) Ethernet switches and routers

16. Specific equipment not required to meet ANSI/ASQC Quality standards but must have Quality Assurance Program approval by the SEPTA Project Manager, shall include the following:

   a. Items or systems as determined by the SEPTA Project Manager

1.10 SUBMITTALS

A. Contractor shall submit his QC Plan along with the CPM Plan/Schedule. The QC Plan documents shall consist of two (2) distinct submittals, the Part I Submittal for QC work during the first 90 calendar days of Notice to Proceed and the Part II Submittal for QC work for the entire Contract period. The QC Plan shall detail the procedures, instructions and reports to be used to demonstrate conformance with the Contract. Unless specifically authorized in writing, no design or construction shall be started until the Contractor's quality control plan is approved by the SEPTA Project Manager. This plan shall include, as a minimum:

   1. An organization chart showing the relationship of the quality control agency to other elements of the construction team.
   2. Names and qualifications of all personnel in the quality control agency.
   3. Area of responsibility and authority of each individual in the quality control agency.
4. A listing of outside agencies such as testing laboratories, architects, and consulting engineers that will be employed by the Contractor, and a description of the services these firms shall provide.

5. Procedures for reviewing all shop drawings, certificates, or other submittals for contract compliance, including the name(s) of the person(s) authorized to sign the submittals for the Contractor as complying with the Contract.

6. An inspection schedule in three parts:
   a. Part I consists of a list of onsite and offsite testing, indicating which test shall be performed, where, and by whom, even if already listed in the Specifications.
   b. Part II consists of a checklist of all specified material and a list of material inspections keyed to Part I and the CPM Plan/Schedule and Specifications.
   c. Part III consists of a list of submittals to include all specified submittals and an indication if for record or for approval, keyed to Part I and Part II and the specifications.

7. A work flow chart showing the sequence of operations and control points for test, inspection and validation

8. Methods and procedures of documenting the quality control operation, inspection, testing, and validation, including a copy of all forms and reports to be used for this purpose.

B. Index of Quality Control Records: The Contractor shall submit the Index of Quality Control Records

C. Quality Control Manager Qualifications: The Contractor shall submit the name, qualifications, and experience of the proposed Quality Control Manager before starting Work.

D. Quality Control Personnel Qualifications: The Contractor shall submit the names and resumes of all of the Quality Control personnel assigned to the Quality Control Manager to show their qualifications.

E. Quality Control Inspection Reports: The Contractor shall submit daily Quality Control Inspection Reports.

F. Quality Audit Reports: The Contractor shall submit Quality Audit Reports of Contractor-performed audits.

G. Serialization Plan: The Contractor shall submit a serialization plan for the System equipment.

H. Completed Serialization Plan and Serial Number Databases: The Contractor shall submit completed plans and databases for the System equipment that reflect final as-installed conditions. The Contractor shall submit updated plans and databases for each project stage.

I. Inspection and Test Plan: The Contractor shall submit the test and inspection plans in accordance with the specification requirements.
J. Document Control Procedures: The Contractor shall submit proposed document control requirements in accordance with the specification requirements and in accordance with 49 CFR 236.18, 49 CFR 236 Subpart H and 49 CFR 236 Subpart I for document and product revision control.

K. Nonconformance Reports: The Contractor shall submit a weekly Nonconformance Report identifying all substandard inspections and tests performed during the previous week

1.11 WARRANTIES

A. General

1. The following Warranty provisions supplement the provisions provided within the Agreement.

2. The Contractor warrants that all goods, supplies, subsystems, equipment, design, engineering, manufacture, installation, repair, rework and other work covered by this Contract shall be satisfactory for their intended purpose, and shall conform to and perform as called for in the Contract requirements and Technical Provisions and shall be free from all defects and faulty materials and workmanship. The warranties set forth in this article are exclusive and no other warranties of any kind, whether statutory, written, orally expressed or implied (including all warranties of merchantability or fitness for particular purpose) shall apply except as otherwise provided in this Contract.

3. The warranty provisions contained herein shall apply to the SEPTA CARD System in its entirety. The term, “SEPTA CARD System” as used herein refers to the complete and functional SEPTA CARD System including but not limited to the technology, systems, sub-systems, components, and equipment installed on or in the wayside, vehicles, and control center offices (both primary and standby), software, interfaces and communications links utilized for the SEPTA CARD System. The SEPTA CARD System shall also be defined to include all hardware and software associated with diagnostics, simulators or simulation equipment, special tools or test equipment, training materials, programs and or any constituent element direct or peripheral to the purpose or function of the SEPTA CARD System.

B. Warranty Period

1. Except as otherwise provided in this Contract, the warranty for all goods, supplies, subsystems, equipment, design, engineering, manufacture, installation, repair, rework, and other work covered by this Contract, shall extend for a period of Three (3) years (the Warranty period).

2. Due to the staged nature of the work, the Warranty period shall commence on final project acceptance by the SEPTA Project Manager except where it can be shown that SEPTA gains beneficial use of SEPTA CARD sub-systems, equipment, or components, independently functioning in revenue service.

3. The warranty period for staging materials shall commence when the staged
components are accepted and successfully operating in revenue service.

4. The warranty period for simulators, test equipment, specialized tools, etc. shall commence upon receipt of delivery to SEPTA.

C. Maintenance of Warranties

1. During the Warranty Period or any extension to the warranty that may arise under the provisions of this Technical Specification, qualified Field Engineers/Technicians, knowledgeable in the repair and maintenance of the SEPTA CARD System, shall be available on site within 24 hours of notification of a warranty issue. The Field Engineers/Technicians shall follow up on all warranty claims and shall assist the SEPTA Project Manager in the resolution of any operating, repair, and troubleshooting or maintenance problems. Should the Contractor contest any warranty claim, the field engineer and SEPTA shall make a joint inspection, with a written report made by the Field Engineer to SEPTA concerning the Contractor’s proposal to resolve the claim. SEPTA shall review the proposal and if found acceptable, the Contractor shall proceed in correcting the defective work. If SEPTA does not accept the proposal, the Contractor shall proceed in accordance with SEPTA’s instructions and the matter shall be treated as a Contract dispute in accordance with the Agreement.

2. Replacement parts and repairs provided pursuant to corrective work hereunder shall be subject to prior approval of the SEPTA Project Manager and shall be tendered and performed in the same manner and extent as items originally delivered. Any warranty work shall be accomplished with a minimum of disruption of SEPTA operations and its maintenance and service facilities. SEPTA will make every reasonable effort to make such facilities and elements of the SEPTA CARD System available to the Contractor consistent with SEPTA’s operational requirements.

3. In the event the Contractor is required to perform warranty work and is unable or fails within the time prescribed to commence and diligently pursue and complete the corrective work, SEPTA is by this provision authorized by the Contractor, at the option of the SEPTA Project Manager and upon written notice to the Contractor, to contract with another or to use its own forces for the performance of the warranty work. The costs of such work may be deducted from monies due, or to become due, the Contractor. If no monies are then owed the Contractor, SEPTA shall invoice the Contractor for such costs, and the Contractor shall pay the invoice within thirty (30) calendar days of its receipt. Contractor hereby agrees to reimburse SEPTA for all costs and expenses in connection with such corrective work.

D. Performance Requirements

1. In the event any single failure mode develops (as distinct from failures due to all or various causes) on a single line replaceable unit (LRU), system or component (each an “Item”) and in which the rate of such failure reaches ten percent (10%) of the population of the Item prior to the expiration of the Warranty period or any extensions thereof, the Contractor shall provide repairs, adjustments, or redesign
and replacement at no cost to SEPTA on one hundred percent (100%) of the items concerned, not just the failed items. Such correction shall be to SEPTA’s satisfaction.

2. In the event, prior to the expiration of the Warranty period or any extensions thereof, the SEPTA CARD System fails to achieve the Reliability Goals stated in Section 01450 “Reliability, Availability, Maintainability and Safety” a detailed analysis shall be performed and an assessment made whether such system, subsystem, or component is to be repaired, or the defective parts replaced, or software modified, or some combination thereof. The analysis as to which alternative will be used shall be based upon minimizing down time of the SEPTA CARD System. Contractor shall perform such necessary change or repair or may, at its option, arrange such necessary change or repair by SEPTA under the supervision and at the expense of the Contractor.

3. If the Contractor fails to demonstrate that such failure(s) were not the result of defects in design, engineering, application, software, workmanship, manufacture, installation and/or material, Contractor shall redesign and replace (repairs and adjustments do not constitute redesign) the affected Items, to correct and prevent failure of the SEPTA CARD System. The Contractor shall perform such tests as SEPTA may deem necessary to verify that such redesign complies with the requirements of the Contract. All costs associated with such redesign, testing and repair, including but not limited to removal, replacement, and reinstallation, shall be borne by the Contractor. Such redesigns and tests shall be subject to approval by SEPTA.

4. Any retrofit, modification, redesign, or replacement work performed under warranty on any SEPTA CARD System item during the warranty period, or detected during the warranty period and performed after the warranty period expires, shall be guaranteed against material, design and workmanship defects for two (2) years from the date of such retrofit, modification, repair or replacement.

5. In no case shall the corrections, under the warranty or otherwise, of defects in design, workmanship and/or materials, result in an increase in maintenance requirements, work or cost to SEPTA without prior written SEPTA approval.

6. SEPTA owned parts shall not be used for warranty purposes without the express written approval of the Project Manager. Any SEPTA owned parts used for warranty purposes shall be promptly replaced with new parts or, subject to SEPTA’s written approval, with reconditioned or repaired parts.

E. Corrective Action during the Warranty Period

1. Warranty work shall be acknowledged and monitored by the parties using a work order system.

2. The Contractor will provide all labor, materials, equipment, components, tools and test devices to perform all retrofit programs, correction of SEPTA CARD System defects or failures, and reliability program corrective actions.
3. SEPTA will send the Contractor a written notice of observed defects or failures with reasonable promptness, but in any event no later than seven (7) days after observing the defect or failure. Unless otherwise directed in said notice, the Contractor shall commence corrective work or provide supervision, as provided here-in, at the time specified by SEPTA but in no event later than two (2) working days following notification by SEPTA of the defect or failure. The Contractor shall advise SEPTA before commencing the corrective work, and shall be prepared to demonstrate the work to SEPTA personnel. The Contractor shall diligently pursue such corrective work to completion. To prevent delays and disruption to SEPTA’s operations, SEPTA shall have the right, when practical and feasible in its opinion, to continue use of any such equipment, subsystems and work deemed defective or unsatisfactory, until such equipment can be taken out of service pursuant to the corrective work hereby undertaken by the Contractor.

4. In the event a defect or failure, in the opinion of SEPTA, constitutes an emergency which will jeopardize or impair the operations and schedules of revenue service, SEPTA will provide the Contractor both verbal and written notice thereof and the Contractor shall commence corrective work within twenty-four (24) hours after receipt of written notice. Under such emergency conditions, the Contractor, with approval of the SEPTA Project Manager, may utilize spare parts from SEPTA’s spare parts inventory, provided the Contractor agrees to replace each and every spare part so used within the time period to be prescribed by the SEPTA Project Manager. Nothing herein shall be construed as preventing SEPTA’s forces from immediately commencing corrective work, provided all such corrective work is performed in accordance with the Operations and Maintenance Manuals furnished by the Contractor. The Contractor shall reimburse SEPTA for actual costs of labor, fringe benefits and overhead at the prevailing rates when the work is performed. SEPTA shall advise the Contractor of the current rates. SEPTA shall also be reimbursed for 125% of its actual material costs. Any corrective work by SEPTA’s forces shall not invalidate Contractor’s warranties and other provisions contained in this Article.

F. Manufacturers Warranties

1. The Contractor shall obtain all manufacturer’s warranties and guarantees of all equipment and materials required by this Contract; provided that the delivery of such manufacturer’s warranties and guarantees shall in no respect relieve the Contractor of its obligation under this Article. Unless expressly waived in writing by the Project Manager, no such manufacturer’s warranty or guarantee shall not expire prior to the date of expiration of the warranty/guarantee provided by the Contractor for such item under this Article nor shall it contain any terms substantially different than required under this Contract. SEPTA, by accepting the manufacturer’s warranties and guarantees provided by the Contractor, in no respect waives any of its rights as against the Contractor, and should there be a failure of the applicable manufacturer to honor any such guarantee or service obligation or a failure of the Contractor to secure any such rights from the manufacturer for SEPTA, SEPTA may, in its discretion, enforce any such rights against the Contractor.

2. The Contractor shall transfer to SEPTA all unexpired manufacturers’ warrants
and guarantees for materials and equipment installed on the Project. Such warranties and guarantees shall recite that they are enforceable by SEPTA.

PART 2 - PRODUCTS – NOT APPLICABLE

PART 3 - EXECUTION

3.01 IMPLEMENTATION

A. Perform a preparatory inspection prior to beginning each class or type of work. Preparatory inspection shall include a review of Contract requirements; review of approved design, shop drawings, and submittal data; a check to ensure that arrangements have been made to provide required control testing; an examination to ascertain that all preliminary work has been completed; and a physical examination of materials and equipment to ensure that they conform to approved design, shop drawing, or submittal data.

B. Perform an initial inspection as soon as a representative segment of the particular item of work has been accomplished. Initial inspection shall include performance of scheduled tests, examination of the quality of workmanship, a review for omissions or dimensional errors, and approval or rejection of the initial segment of the work.

C. Perform additional testing, validation, and inspection to ensure continuing compliance with Contract requirements.

D. Perform a final inspection and validation after each separately identifiable work element has been completed to ensure that all work is in compliance with Contract requirements.

E. The Contractor shall provide advance notification to SEPTA of any material testing, either in-house or by an outside agency, a minimum of 10 business days prior to performance of the test.

3.02 MANUFACTURING QUALITY CONTROL

A. The Contractor shall be responsible for his suppliers to maintain a quality control system which shall effectively provide adequate policies and controls (inspections and tests) to ensure that all elements affecting quality in the design, production, transportation, storage, and installation or use of items are controlled. It shall require the maintenance of records showing adequate calibration, inspection, measurements, tests, and other objective evidence of quality. The SEPTA Project Manager may survey the manufacturing quality control systems and records at any time to determine compliance with the above requirements.

3.03 QUALITY CONTROL REPORTING

A. Where test results by a testing laboratory are provided, they shall cite the Contract requirements, the actual test results, and include a statement that the item testing conforms (or fails to conform) to the Specification requirements. All testing laboratory reports shall be certified and sent to the SEPTA Project Manager, in triplicate.

3.04 QUALIFICATIONS OF MATERIAL TESTING LABORATORY
A. Satisfy "Recommended Requirements for Independent Laboratory Qualifications", published by American Council of Independent Laboratories.

B. The Contractor shall notify SEPTA thirty (30) days in advance of any qualification or certification testing performed by outside agencies. SEPTA reserves the right to attend these tests.

C. Testing Equipment

1. Calibrate at maximum 12-month intervals or as required by certifiable reports, by devices of accuracy traceable to either:
   a. National Bureau of Standards
   b. Accepted values of natural physical constants

2. Submit a copy of certificate of calibration.

3. Promptly notify SEPTA Project Manager and the Contractor simultaneously of irregularities or deficiencies of work which are observed during performance of services.

4. Promptly submit three copies of reports of inspections and tests to the SEPTA Project Manager including:
   a. Data issued
   b. Project title and number
   c. Testing laboratory name and address
d. Name and signature of inspector
   e. Date of inspection and sampling
   f. Record of temperature and weather
   g. Date of test
   h. Identification of product and specification section
   i. Location of project
   j. Type of inspection or test
   k. Observations regarding compliance with Contract Documents

5. Stamp fabricated items found to be in compliance with field measurements and the Contract Drawings and Specifications.
SECTION 01450

RELIABILITY, AVAILABILITY, MAINTAINABLITY, & SAFETY

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

A. General

1. The work of this Section includes, but is not limited to, providing a Reliability, Availability, and Maintainability (RAM) Program and all associated labor, materials, tools, equipment, and incidentals necessary for the CARD System, in accordance with the Contract Documents.

2. The Contractor shall provide a Reliability, Availability and Maintainability assessment and analysis for all SEPTA (CARD) System equipment.

3. The work to be done under this Section also consists of establishing and maintaining RAM Programs, approved by SEPTA. These programs shall be planned, integrated and developed in conjunction with design and production functions to assure that the overall system operates dependably and economically.

4. All reliability, availability, and maintainability calculations, verifications, and demonstrations shall be performed as a whole for the system.

5. The Hardware and Software reliability prediction and estimation methodologies shall be defined in the RAM Program Plan.

6. All types of any failure, error, malfunction, and other anomaly that may limit or prevent a component from performing its intended function, or limit the availability of use for an intended function, or produce a result from a function that is other than that desired and intended, shall be classified as a failure. These shall be calculated into the Reliability, Availability, and Maintainability of the provided system. Four types of failures are specifically recognized for the system and these are:

   a. Safety Critical Failure is a failure of any component, feature, or function that provides information, logic processing, transmission, reception, display, or integration to a separate system, if lack of availability or erroneous function can result in any condition or state that either: a) is less safe than would otherwise exist; or, b) fails to provide a safety function required by regulation.

   b. Operational Failure is any failure condition that results in reduced operational capacity in any manner that is not in the Safety Critical category (above), including degraded performance.

   c. Functional Failure is Non-Safety Critical and Non-Operational condition. Any unintentional condition that does not directly impact safety or impact operations but either: a) requires an action of any type to return a component
or function to its normal or proper condition; or, b) the component or function fails to perform its intended function or is otherwise unavailable for its intended use.

d. Any Non-Functional and Non-Operational Failure is any condition that does not fall into any of the previous categories, and may either be recoverable or may require attention to correct the condition. As example, failure of a captive nut to remain captive in normal use as required, but the failure does not result in operational impacts.

7. Safety Critical, Operational and Functional Failure are critical to the successful implementation of the SEPTA CARD System and shall be calculated into the Mean Time between Failures (MTBF) and Mean Distance between Failures (MDBF). These failure types shall all be addressed within the documentation submitted for approval to SEPTA and shall be addressed in the Reliability, Availability, Maintenance, and Safety (RAMS) plans. The Non-Functional and Non-Operational failures may impact maintainability and long term system reliability and shall be addressed by the Contractor within either the RAMS plans or other documentation.

8. The Contractor shall submit an overall Reliability, Availability, and Maintainability Plan for the SEPTA CARD system, including appropriate system/sub-system requirements specifications, test plans, and contract statements. This shall include all parts of the system, hardware, software and procedures.

9. The Contractor shall use industry standard reliability parameters such as:

   a. Mean Time between Failures (MTBF) which is the arithmetic mean (average) time between any failures of the system. The MTBF is typically part of a model that assumes the failed system is immediately repaired (zero elapsed time).

   b. Mean Time to Failure (MTTF) which is the arithmetic mean time until a design’s or component’s first failure. This may include external failures, disruptions in the operation of the system, process, procedures, or design occurs.

   c. Mean Distance between Failures (MDBF) which is the arithmetic mean (average) distance travelled between any one system failure and the next system failure.

   d. MDBF shall be provided for all onboard systems and components, and MTBF shall be provided for all other systems and components. MDBF and MTBF shall be calculated in general conformance to applicable Sections of military handbook MIL-HDBK-217, latest revision.

10. The Contractor shall prepare and furnish an Availability Analysis of the SEPTA CARD system. Each separate Availability Analysis shall be based on a corresponding availability block diagrams and shall state the MDBF, MTBF and the Mean-Time-To-Repair (MTTR) of all System components.
11. All SEPTA CARD critical functions and functions necessary to support critical functions (inclusive of all hardware, software and data supporting those functions) without exception, shall execute as specified and without degradation in response times for the system to be considered available as a Critical System.

12. Where improper operation of equipment or systems could result in the unsafe operation of any element or component of the SEPTA CARD system, the system shall provide an alarm, indicate the failure, restrict the speed of the vehicle, and/or provide other means to communicate the condition and provide safest possible condition as may be appropriate.

13. The Contractor shall provide within the RAM plan a means and method for maintaining all system components. The plan shall include number and type of personnel required to perform routine maintenance and trouble shooting. The staffing provided shall be based on the predictive analysis submitted by the Contractor.

14. The Contractor shall perform a maintainability analysis that must be the basis for development of tasks, procedures, methods and techniques for maintenance. This analysis shall include:

   a. Show all maintenance tasks required
   b. Required work force and equipment required
   c. Task frequency and time required
   d. Required skills, support parts and equipment

B. Vehicle Systems

1. Interchangeability

   a. All similar parts on each vehicle and among all other vehicles and their spare parts shall be designed and manufactured to be identical, both as individual parts and as sub-assemblies. Model numbers for identical components shall be identical. Replaceable components of any such apparatus shall be fully interchangeable, without adjustments to any part or system being necessary. Microprocessor hardware units which are physically identical except for the software shall have identical part numbers. An Engineer approved subpart number may be used to identify differences by software. Such units which require location-specific module inputs shall have this performed by vehicle body wiring configuration, and not by the use of DIP switches or similar. Specific approval shall be obtained from the Engineer during Design Review or each part whose replacement may require an adjustment, and such approval may be granted only where it can be shown to be absolutely necessary.

2. Reliability
a. The Contractor shall establish a database to monitor the reliability of the CARD System, measured as Mean Distance between Failures (MDBF) or Mean Time Between Failures (MTBF).

3. The CARD system shall have a MDBF of 100,000 miles.

a. An average operating speed of 27.5 miles/hour may be used for design calculations. For the above, a chargeable failure shall be defined as any equipment related occurrence considered by SEPTA as rendering the vehicle unfit for service; or as any maintenance action requiring repair or replacement of any sub-system or whole-vehicle component which is not an approved consumable item (or which is approved as being a consumable item but is not achieving its design service life) and which failure has not either been due to a failure occurrence in equipment of another sub-system, or due to failure of SEPTA to perform the recommended preventive maintenance actions, vandalism or physical mistreatment at a human interface, operating or weather conditions of unusual aspect or severity beyond those noted above, or due to accident. The term "unusual aspect or severity" shall be understood to mean a condition that does not occur on SEPTA at less than 10 year intervals. The time, place or type of service operated by the vehicle at the time of a failure shall not be of any consequence.

D. Control Center

1. The MTBF, MTTHE, and the MTTR shall be provided by the selected manufacturer as a part of the required Availability Analysis. Critical assumptions and analyses relevant to the MTTHE shall also be provided and incorporated where appropriate.

2. MBTF, MTTHE, and MTTR, shall be provided for both the individual sub-systems supporting the CARD system, and for the CARD system as an entire system.

3. To the extent possible, the CARD Control Center and Back-Up Control Center systems shall be designed using modular / replaceable units and furnished with all tools, specialty tools, computer interface cables, licensing, and training necessary to maintain, upgrade, and extend onto new operating territories.

4. System design shall incorporate system redundancy and failover control mechanisms to provide seamless transfer between normal and stand-by sub-system components.

5. Individual unit of equipment to be furnished for the CARD Control Centers shall be designed for maximum reliability, so that it will be able to perform its specified functions under the required conditions.

6. To provide for the maintenance needs of each system after acceptance of system and expiration of any warranty and/or Contract maintenance agreements, the system design shall support the following:
a. Monitoring of all system and sub-system activity, communications, processor utilization, alarms, etc;

b. Routine system support such as periodic forced failovers, etc.

c. Design, development and implementation of modifications to software and databases;

d. Maintenance of all system documentation, configuration control, etc;

e. The Contractor shall certify in writing that the equipment provided under this Section, including software and future software revisions, both executive application, and user-defined, shall be available and will be serviced and supported for a period of ten (10) years after Contract completion.

7. All sub-system components shall be designed to provide troubleshooting indications of health via the Network Management System.

8. The Contractor shall provide diagnostic software and equipment to maintain all systems and their components. The Contractor shall provide software that is simple to use and have filtering capabilities to drill down to specific sub-system component or application. All codes and error codes shall provide a complete description of the error, items that may cause the error and information or how to clear and correct the failed component or software module.

E. Radio System

1. The MTBF shall be provided by the selected manufacturer as a part of the required Availability Analysis.

2. The SEPTA CARD radio Communications System shall be furnished with all tools, specialty tools, computer interface cables, licensing, and training necessary to maintain the radio system.

3. All hardware shall be designed using a LRU methodology and provide troubleshooting indications of health via the Network Management System and the minimum effort for LRU replacement of hardware.

4. The Contractor shall provide diagnostic software and equipment to maintain all systems and their components. The Contractor shall provide software that is simple to use and have filtering capabilities to drill down to specific LRU’s and components. All codes and error codes shall provide a complete description of the error, items that may cause the error and information or how to clear and correct the failed component or software module.

1.02 RAM PROGRAM

A. RAM Requirements
1. Description: The Work specified in this Section includes the Contractor requirements for implementing an overall Reliability, Availability, and Maintainability (RAM) Program Plan, encompassing system reliability, availability, and maintainability engineering practices to be applied on the project.

2. The Contractor’s program shall include the development of a specific RAM Program Plan (RPP) that shall describe the supplier’s RAM organization, equipment design-for-RAM features, Failure Reporting and Corrective Action System (FRACAS), detailed project life cycle RAM tasks and milestones, and methods for evaluating and demonstrating system reliability, availability, and maintainability.

3. The RAM Program Plan requirements shall apply to all Contractor functions and subcontractors during all phases of the Work, including design, construction, installation, testing, pre-revenue operations, in-service support, warranty, retrofits and field modifications.

1.03 QUALITY ASSURANCE

A. The Contractor shall pretest all instrument houses or instrument racks and site specific application programming prior to the factory acceptance test. Documentation of such pre-testing shall be submitted for approval prior to the scheduling of the factory acceptance test.

B. The quality of the SEPTA CARD system installation shall be assured through the performance by the Contractor of tests and inspections made during the progress of this Contract and after completing the installation of equipment.

C. The Contractor shall devise and perform field installation inspections to ensure that all equipment furnished in association with this Contract performs in compliance with these Specifications.

E. The Contractor shall devise and perform such tests as are required by these Specifications to ensure that all systems, sub-systems, and operating equipment provided under this Contract function in a safe and reliable manner.

E. The validity of each test shall be demonstrated to the SEPTA Project Manager, either at the factory with simulated equipment or in the field on newly installed equipment. The SEPTA Project Manager must be satisfied that the test procedure adequately determines that the equipment is working properly, in a safe manner, and that it meets or exceeds the requirements of the Specifications. The SEPTA Project Manager shall signify his satisfaction with the test procedure by placing his signature on the first page of the document. No test procedure which has not been signed by the SEPTA Project Manager and Contractor will be considered valid.

1.04 DEFINITIONS FOR RELIABILITY ASSESSMENT PROGRAM

A. The following definitions apply specifically to terms used in this Section. Meanings of terms not defined herein are in accordance with the definitions in MIL-STD-721
1. Mean Time to Hazardous Event (MTTHE) - The average or expected time that a subsystem or component will operate prior to the occurrence of an unsafe failure.

\[
MTTHE = 10 \text{ TO THE } 9\text{TH} \text{ HOUR}
\]

2. Mean Time Between Failures (MTBF) - The average time that equipment will operate without a chargeable failure.

\[
MTBF = \frac{\text{Operating time}}{\text{Number of chargeable failures}}
\]

- Minimum MTBF (MMTBF) - The value determined by the Authority for minimum performance without rejection.

- Specified MTBF (SMTBF) - The value specified in the Table of Reliability Requirements. This value is determined by multiplying the minimum MTBF (MMTBF) by the discrimination ratio (DR) of the Test Plan, and is used to limit the Contractor's risk.

3. Discrimination Ratio (DR) - The ratio of the specified MTBF (SMTBF) to the minimum MTBF (MMTBF)

\[
DR = \frac{\text{SMTBF}}{\text{MMTBF}} = \frac{\theta_0}{\theta_1}
\]
4. Decision Risks

- Authority Risk (AR) - The probability of accepting the total system with a true MTBF equal to the minimum MTBF (MMTBF). (The probability of acceptance with a true MTBF less than the minimum MTBF (MTBF) will be less than AR.)

- Contractor Risk (CR) - The probability of rejecting the total system with a true MTBF equal to the specified MTBF (SMTBF). (The probability of rejection with a true MTBF greater than the specified MTBF will be less than CR.)

5. Importance Index (I.I) - A factor used to convert the MTBF of all line items of the Table of Reliability Requirements to a common base for the purpose of trade off analysis and requirement redistribution. The following factors are considered in selecting the value of the I.I for each line item:

- Impact of failures in this line item on system operation
- Repair time required per failure
- Estimated quantity used in system.

6. Mean Time to Restore (MTTR) - The average active repair time required to perform all the tasks associated with a complete corrective maintenance action. This includes the times to isolate the fault, obtain access, remove and repair/replace defective components or parts, perform required adjustments, perform tests to see that the fault has been corrected, and replace all removed parts, covers, seals, etc. Active repair time does not include maintenance team travel time, time to transport failed components to the site, time waiting for parts, personnel, or space, etc. MTTR is a measure of the maintainability of the design and equipment. The time required locating and repair dependent (non-chargeable) failures shall be included in the total restore time.

\[
MTTR = \frac{\text{Restore time accumulated}}{\text{Number of chargeable failures}}
\]

\[
X = MTTR
\]

\[
X' = MTTR \text{ calculated from logbook entries}
\]

\[
X = MTTR \text{ specified in the Table of Reliability Requirements}
\]

\[
0
\]

\[
X = \text{Maximum acceptable MTTR}
\]

\[
1
\]
a. All MTTR estimates shall assume the following:

1) Troubleshooting and repair will be performed by a qualified individual, or by a high school graduate who has two years of technical school training and one year of experience and has at his disposal all of the Contractor's printed maintenance literature.

2) All spare part quantities and test equipment, as mutually agreed between the Contractor and the SEPTA Project Manager, shall be available and in a state of readiness.

3) Maintenance will be performed at three discrete levels: on-line, off-line, and bench.

4) On-line maintenance is that performed on an in-place and operational equipment element. Test points or built-in indicators shall facilitate identification of interfaces with other system elements. On-line maintenance shall not disrupt service.

5) Off-line maintenance is that performed on in-place, but out of service, equipment elements. Equipment that frequently enters and leaves revenue service will be tested periodically to verify proper operation. Special test equipment shall thoroughly exercise each equipment function. The test equipment shall facilitate fault isolation to the functional module level.

6) Bench maintenance is that which is performed on out-of-place and out-of-service equipment elements. This maintenance is to be performed in a shop area where standard test equipment and fixtures are available.

b. Test equipment and procedures shall allow maintenance to the lowest pluggable component part level.

7. Failure

a. Any malfunction or fault which prevents or limits equipment from performing its function in accordance with these specifications.

1) Failure Rate - The reciprocal of MTBF; for this reliability assessment program, the failure rate is assumed to be constant throughout the life of the equipment.

2) Independent Failures - A failure which will independently cause equipment performance outside of specified limits - one which occurs without being related to the failure of the associated items.
3) Dependent Failure - A failure of part which is a direct result of an independent failure; one which is caused by the failure of an associated item(s). Dependent failures are not chargeable failures

4) Simultaneous Failures - In the event simultaneous, or multiple independent failures occur; each failure which will independently prevent satisfactory equipment performance shall be counted as an equipment failure.

5) Chargeable Failure - All failures which require repair or replacement of a component or part are chargeable unless specified otherwise herein, or unless determined by the Engineer to be caused by a condition external to the equipment under test. Failure due to workmanship deficiencies shall be counted as chargeable. Also, transient conditions which temporarily prevent a function from being successfully performed shall be counted as chargeable failures unless it is shown that they are the result of external influences beyond the requirements of this Specification.

6) Non-Chargeable Failures - Failures which are proven to be the result of conditions exceeding those specified (i.e., floods, derailments, vandalism, human error not normally protected against, etc.) shall be classed as non-chargeable and shall not be included in the reliability evaluation. Failure of parts installed by others (such as track bed, rails, normal and reserve AC power sources, etc.) that causes a dependent failure of the Contractor's equipment shall not be included in the reliability evaluation.

7) Confidence Level - The probability of rejecting a system, when the true failure rate is at the failure rate specified for acceptance

1.05 SUBMITTALS

A. Each submittal required herein shall be submitted for the approval of the SEPTA Project Manager and review by the Engineer in accordance with the Submittals Section of these Specifications.

B. Reliability Assessment Program

1. The Contractor shall submit a proposed Reliability Assessment Program for approval. The program shall include, but not be limited to:

   a. Organization and responsibilities of the proposed reliability effort

   b. Details of the design and component selection and screening processes proposed to be used to meet the reliability requirements

   c. Details of the procedures proposed to be used to calculate MTBF and MTTR predictions
d. Identification of sources proposed to be used for component reliability data

e. Proposed serialized type forms and reports, including preventive maintenance and discrepancy reports specifically for the joint use of the Contractor and the Authority during the field reliability assessment testing program

f. Proposed reliability database program, which captures all failures of the system to perform its intended function, includes human errors, product failures, and software defects. This shall be a living document throughout the life of the project and through the warranty period

C. Availability Assessment Program

1. The Contractor shall submit a proposed Availability Assessment Program for approval, which covers the life cycle of all systems and sub-system components. The program shall include, but not be limited to:

a. Product listing and life cycle for each component/assembly, etc.

b. Organization and responsibilities of key personnel

c. Internal procedures and control implementing the Availability Program

d. Interfaces with, and support to, reliability, system safety, and other closely related programs, and support to system design effort as a whole

e. Methods for assuring that Sub-Contractors’ and Suppliers’ product availability efforts are consistent with overall system requirements

f. Descriptions of availability analyses to be used during manufacturing for estimating resource requirements, and for demonstrating compliance with the requirements of this Contract

g. Provisions to evaluate operational needs and design changes for possible effects upon available parts

h. Provisions for spare parts and backwards compatibility on newer version parts

D. Maintainability Assessment Program

1. The Contractor shall submit a proposed Maintainability Assessment Program for approval. The program shall include, but not be limited to:

a. Task listing and time phasing for each task

b. Organization and responsibilities of key personnel
c. Internal procedures and control implementing the maintainability program

d. Interfaces with, and support to, reliability, system safety, and other closely related programs, and support to system design effort as a whole

e. Methods for assuring that Sub-Contractors' and Suppliers' maintainability efforts are consistent with overall system requirements

f. Descriptions of maintainability analyses to be used during design and development for estimating maintenance resource requirements, and for demonstrating compliance with the maintainability requirements of this Contract

g. Provisions for assuring that features for accessibility, early fault detection, rapid fault isolation to the proper service level, and simplification of fault detection/isolation/repair tasks are incorporated in the design

h. Provisions to evaluate operational and design changes for possible effects upon maintainability requirements

i. Provision of a plan for formal verification of compliance with maintainability requirements

E. Predicted Reliability Reports

1. Within 90 days after award of the Contract, a reliability study shall be made and a report showing the predicted reliability for each sub-system shall be forwarded to the SEPTA Project Manager. If areas of common failure appear inherent in the design or equipment specified, an alternate design or equipment change shall be proposed for the Engineer's review.

2. The reliability report shall be updated and reissued each 30 days. It shall indicate for each sub-system the estimated percent of design completion upon which the reliability prediction is made.

3. The report shall include an analysis of items for which the prediction does not meet the reliability requirements or for which the prediction has changed significantly from the last report. For items predicted not to meet the reliability requirements, the corrective action proposed shall be described in this section of the report.

4. Whenever deviations of the predicted reliabilities are encountered during design (i.e., prior to production), an updated reliability report shall be forwarded to the SEPTA Project Manager. If these reports indicate a marked decrease in predicted reliability, the Engineer may require an alternate design or equipment change to increase the predicted reliability to the requirements specified in the Table of Reliability Goals.

F. Final Documentation

1. Upon completion of specified reliability testing the Contractor shall submit a final

1. The Contractor shall submit a Maintenance Concept Report defining the repair, corrective, and preventive maintenance program plans, policies, and support requirements for all equipment supplied under this Contract. The report shall include, but not be limited to:

   a. Minimize each level of maintenance consistent with system reliability, availability and maintainability requirements

   b. Be fully responsive to the operating concept, duty cycles, and the design requirements of the system

   c. Provide recommendations for all maintenance engineering, plans and procedures, facilities planning, maintenance tools and equipment selection, maintenance staffing, logistic support planning, recommended spare parts, and related system objectives

   d. Recommend policies and practices which assure that, at the time of a failure, qualified maintenance personnel will be available, will be promptly notified, will be strategically located so as to minimize travel time, and will have the necessary documentation, tools, test equipment and spare parts to effect the repair in a minimum of time within the limits of reasonable cost/benefit considerations

   e. Provide recommendations for spare parts, which considers the repair and return service cycle established in the Maintainability Assessment Program.

H. Reliability, Availability, and Maintainability (RAM) Program Plan: The Contractor shall submit a RAM Program Plan covering the system, sub-systems, and equipment. The plan shall describe the supplier’s RAM organization, equipment design-for-RAM features, Failure Reporting and Corrective Action System (FRACAS), detailed project life cycle RAM tasks and milestones, and methods for evaluating and demonstrating system reliability, availability, and maintainability.

I. Reliability, Availability, and Maintainability (RAM) Calculations: The Contractor shall submit a RAM Calculations document showing compliance with system RAM specifications. Methods of analysis shall include Reliability Block Diagrams or similar. Calculations shall be based on failure and repair rates from field service history (preferred) or MIL-HDBK 217F calculations when field service history is not available.

J. Monthly System RAM Progress Reports: The Contractor shall submit monthly system RAM progress reports covering the status of system RAM activities based upon the approved milestone chart included in the RPP.

K. Weekly Maintenance Activity Reports: The Contractor shall submit weekly reports to the SEPTA Project Manager.

1.06 CONSTRUCTION OF TABLES FOR RELIABILITY AND MAINTAINABILITY GOALS
A. The Tables of Reliability and Maintainability Goals are constructed of line items which represent identified functions. The specified table as constructed shall be developed and provided for SEPTA approval. Each line item is assigned a unit of measure, an importance index, a decision risk, the minimum MTBF, and the maximum MTTR.

B. Where alternate devices are used to perform the functions of devices identified, such alternate devices shall be considered part of the line item in which the replaced device is identified.

1.07 DELIVERY

A. The Contractor shall be responsible for providing a Reliability, Availability and Maintainability Program within 120 days of Notice to Proceed (NTP).

PART 2 - PRODUCTS

2.01 MATERIALS

A. Not applicable to this section

PART 3 – EXECUTION

3.01 TESTING

A. Reliability Testing Procedures

1. Approval of detailed test procedures shall be obtained from the SEPTA Project Manager before field reliability assessment testing begins. The test procedures shall include, but not be limited to, the following details:

a. A listing of components, by description, part number, and quantity comprising each line item in the Table of Reliability Goals

b. Test equipment to be used. Test instruments shall meet the requirements of Signal System Tests. The calibration of each instrument shall be certified by a recognized testing facility. Recertification shall be conducted every 90 days or less. Out-of-date instruments will be considered non-certified. Tests conducted with non-certified instruments will be rejected.

c. How test equipment is to be monitored.

d. Graphical sample presentation of the test plan and table to be used

e. Burn-in (debugging) time

f. Performance parameters to be measured

g. Performance limits beyond which a failure has occurred

h. Sample of report and log forms to be used
B. Test Logs

1. The logs shall contain the following information:
   a. Identification of the component and sub-system by location, function, serial numbers, and line item of Table of Reliability Goals to which the equipment is charged
   b. Number of like components and sub-systems in service
   c. Date and time equipment was placed in service
   d. Date and time of each shutdown and reason for same
   e. Date and time equipment restored to test after shutdown
   f. Date and time of each failure
   g. Cause of each failure
   h. Classification of each failure (chargeable, not chargeable)
   i. Time to troubleshoot from time of arrival onsite
   j. Time to repair when spare parts are available onsite
   k. Time to restore to operation
   l. All repairs and adjustments made and reasons for same.

2. Once each week the logs shall be reviewed and the following entries shall be made:
   a. Accumulated operating hours per line item
   b. Accumulated chargeable failures per line item
   c. Accumulated repair time for chargeable failures (actual troubleshooting and repair time only) per line item.

3.02 FAILURE DOCUMENTATION

A. Any malfunction or fault which prevents or limits equipment from performing its function in accordance with these Specifications shall be reported and formally recorded.

B. Equipment Failure Record

1. A failure record shall be maintained for each line item. The record shall be designed to permit keeping of the entire test history of each line item on a single sheet so that widely divergent differences in test behavior between line items may be easily
recognized. This record shall show all component failures for the line item.

C. Corrective Action

1. When any reliability test reaches a reject decision, the test will be discontinued for that line item. The SEPTA Project Manager shall be immediately notified and the Contractor shall develop and propose a plan for correction of the deficiencies. The SEPTA Project Manager will review such corrective action and may require handling as a design change or modification.

D. Failure Summary Record

1. The Contractor shall maintain a failure summary record containing all the information needed to reach an accept/reject decision on the system under test. All entries shall be made directly and there shall be no need to process the date prior to an accept/reject decision. The summary shall include all component failures considered chargeable on all like equipment under test. The record shall present the current test status, including information on the total hours of test, failures, MTTR and MTBF of all units on test.

END OF SECTION
SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK
A. This Section specifies construction facilities and temporary controls required for the Work.

B. Related Work Described Elsewhere

1. Compliance with safety regulations: Compliance with all requirements of pertinent regulations is described elsewhere within these specifications.

2. All Contractor employees working at SEPTA facilities shall participate in SEPTA Roadway Worker Protection (RWP) safety training.

3. Sub-Contractor equipment: Except that equipment furnished by Sub-Contractors shall comply with all requirements of pertinent safety regulations, for items normally furnished by individual trades in execution of their own portions of the work are not part of this section of these specifications.

1.02 PRODUCT HANDLING

A. Protection

1. Use all means necessary to maintain temporary facilities and controls in proper and safe condition throughout progress of the project.

2. Provide temporary heat, fuel, and services as necessary to protect all work and materials against injury from dampness and cold until final acceptance of all work and material in Contract.

B. Replacements

1. In the event of loss or damage, immediately make all repairs and replacements necessary to the approval of the SEPTA Project Manager and at no additional cost to SEPTA.

1.03 LOCAL PROJECT MANAGEMENT OFFICE

A. General

1. Contractor shall establish and maintain a project management office (the “PMO”) to enable SEPTA and the Contractor to plan, organize, direct, coordinate, control, and approve actions undertaken to accomplish the Project objectives. The PMO shall be physically located in Southeastern Pennsylvania within the SEPTA service area. The PMO shall provide management of administration, contracts, subcontracts and technical and quality assurance. The Contractor shall provide recommendations to SEPTA with regard to direction of Project activities as required by SEPTA, to meet the overall Project cost, schedule, and technical objectives.
1.04 CONTRACTOR LAYDOWN AREA

A. The Contractor shall have a contractor’s lay-down area of adequate size for the safe storage of equipment, vehicles, materials, etc, preferably at the Contractor’s field office location.

B. Where materials cannot be exposed to the inclement weather, the Contractor shall provide a secured controlled environment.

C. The Contractor shall make provisions to secure all areas and shall include adequate lighting, security cameras, fencing, and security personnel if deemed necessary. If security personnel are stationed at this location, sanitary service shall be provided.

D. The Contractor shall submit the proposed lay down area for approval.

1.05 REMOVAL

A. Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the work. Remove all such temporary facilities and controls as rapidly as progress of the work will permit or as directed by the SEPTA Project Manager.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION – NOT APPLICABLE

END OF SECTION
SECTION 01600
MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies the requirements for materials and equipment to be supplied by the Contractor. All materials and equipment proposed for use on this Project, whether specified herein or offered as a substitution shall be approved by the SEPTA Project Manager.

1.02 QUALITY OF PRODUCTS

A. Except as may be otherwise indicated in the Contract Documents, products furnished under this Contract shall be new.

1. Materials shall be free of all defects from the manufacturer. Workmanship and products shall be of the highest quality.

2. Products shall be manufactured, handled, and installed in a manner that will ensure that the completed work conforms to the Contract Documents.

B. Compliance with Cited Standards

1. Wherever the Contract Documents require that materials and workmanship, conform to specifically named products, codes, or standards, materials, workmanship, and operations shall meet or exceed the requirements of the latest revision of the specifically named products, codes or standards as of the opening date of the Bid.

2. In procuring all items provided in the Work, it is the Contractor’s responsibility to verify the detailed requirements of the specifically named products, codes and standards and to verify that the items procured for use in this work meet or exceed the specified requirements.

3. When required by the Contract or by written request of SEPTA, deliver to SEPTA proof that the products, materials, and/or workmanship, meet or exceed the requirements of the specifically product named code or standard.

a. Such proof shall be in the form of a certificate of compliance signed by an authorized officer of the manufacturing company, or a certified report of tests conducted by a testing agency acceptable to the SEPTA Project Manager.

4. The SEPTA Project Manager reserves the right to reject items incorporated in the Work that fail to meet specified minimum requirements. The SEPTA Project Manager further reserves the right, without prejudice to any other recourse, to accept non-complying items. Should the SEPTA Project Manager exercise this right, the accepted items shall be subject to an adjustment in the compensation
payable under the Agreement with the Contractor, and determined in accordance with the provisions of the Contract Documents.

1.03 HANDLING AND TRANSPORTATION

A. Products shall be handled in accordance with the following:

1. The Contractor shall arrange, and be responsible for, shipment of all equipment and appurtenances to the site, at his expense.

2. The Contractor shall provide transportation insurance covering materials and equipment. Such insurance shall be for the full value of each shipment.

3. The equipment shall be shipped in assembled units, unless inconsistent with good shipping practice. When items must be disassembled for shipment, they shall be match marked.

4. The Contractor shall agree to assume all risk of loss or damage in transit. The Contractor shall repair or replace any lost or damaged shipment as soon as possible. Damage or loss of equipment or materials shall not be the basis for any claim.

5. Package small parts in containers such as; boxes, crates, or barrels to avoid dispersal and loss. Firmly secure an itemized list and description of contents to each such container.

6. Avoid damage to and over stressing of products. Protect projecting parts by blocking with wood, by providing bracing, or by other approved methods.

7. Protect from soiling and moisture by wrapping or by other approved methods.

B. Transportation

1. Load, transport, unload and store all products in a manner to keep them clean and free from damage or inclement weather.

1.04 STORAGE AND PROTECTION

A. Storage and protection of products shall be in accordance with the following:

1. Provide sheltered weather tight, and heated weather tight storage as required for products subject to weather damage.

2. Provide blocking, platforms, or skids for products subject to damage by contact with ground.

3. Store packed materials in their original unbroken package or container.

4. Protect products from damage during warehouse operations.
5. All electrical equipment shall be protected by weatherproof coverings or shelter. Equipment must be kept dry and must not be allowed to be subject to moisture condensing conditions. Furnish heating or de-humidification as needed during storage to guarantee no moisture damage to equipment. Evidence of finish or surface corrosion shall be cause for rejection of the material, and rejected material shall be removed from the jobsite immediately.

1.05 SUBSTITUTIONS

A. The Contractor shall submit, for each proposed substitution, complete descriptive literature including performance data.

1. Provide samples of proposed items where feasible or as requested by the SEPTA Project Manager. Comply with the requirements of Section 01300- Submittals, Article 1.04.

2. Proof that all material and equipment to be provided as a part of the SEPTA CARDC system meet all environmental requirements. Submitted proof shall include environmental test results from an accredited environmental test facility.

3. Proof that all substituted material and systems can be provided in accordance with the Contractor’s schedule. Delays to the Contract or scheduling delays associated with the substitution of specified equipment are not permitted.

4. Include full and complete information concerning differences between the proposed substitution and the named device.

5. Detail how the use of the substitute will improve the overall project schedule or reduce the project cost.

6. Any savings in cost resulting from such substitutions shall be passed on to SEPTA.

7. Contractor shall assume all responsibility for use of substitutes of specification named products in overall CARD System configuration, regardless of SEPTA Project Manager's approval.

B. The SEPTA Project Manager will be the sole judge as to whether a proposed substitution will be approved.

1. Burden of proof of equivalency shall rest with the Contractor. The SEPTA Project Manager, however, reserves the right to direct usage of the specified material, method, program, system, or device when it is determined by SEPTA to be in the best interests of the project.

2. The Contractor shall abide by the SEPTA Project Manager’s decision when proposed substitutions are deemed unacceptable.

3. Use of substitute items without written approval of the SEPTA Project Manager is
prohibited.

C. The Contractor shall not make any claim for any extension of time or for damages by reason of the time taken by the SEPTA Project Manager in considering a substitution proposed by the Contractor, or by reason of the failure of the SEPTA Project Manager to approve a substitution proposed by the Contractor.

D. Where approval of a substitution requires revision or redesign of any part of the Work, provide such revision and redesign including all new drawings and details required thereof, at no additional cost to SEPTA. All such revision and redesign shall be subject to the approval of the SEPTA Project Manager.

E. It is the responsibility of the Contractor to verify prior to bidding that all specified items shall be available in time for installation during the orderly and timely progress of the Work. In the event specified items will not be so available, notify the SEPTA Project Manager promptly.

F. Costs of delays because of non-availability of specified items, when such delays could have been avoided by the Contractor, shall be the responsibility of, and shall be borne by the Contractor.

G. The Contractor shall be required to prove that all substituted equipment and material meets the environmental requirements of these Specifications. This is to include but not be limited to all temperature, humidity, vibration, mechanical shock, EMI, and dielectric requirements. The Contractor shall be required to retain an accredited environmental test facility, as may be approved by the SEPTA Project Manager, to perform environmental testing of the substituted equipment, materials, or systems. SEPTA reserves the right to witness all environmental testing as may be required to prove that the environmental requirements are met.

H. The Contractor assumes full risk for the use of all substitutes.

1.06 APPLICABLE CODES AND STANDARDS

A. Throughout the Contract Documents, references are made to codes and standards which establish qualities and types of workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics. Such references shall be deemed to mean the latest issue that is in effect on the date of the bid opening.

PART 2 – PRODUCTS – NOT APPLICABLE

PART 3 – EXECUTION – NOT APPLICABLE

END OF SECTION
SECTION 01700

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies the requirements for closing out the project and supplements requirements specified in the Contract Documents.

B. Definitions: Project closeout is the term used to describe collective project requirements that shall be fulfilled near the end of the Contract time in preparation for final acceptance and beneficial use of the Work by SEPTA, as well as final payment to the Contractor and the normal termination of the Contract.

1.02 INTERIM COMPLETIONS

A. In addition to other submittals required as work of this Section, certain items more particularly specified within the various specification sections, such as critical "As-Builts," test data, configuration management, and interim circuit diagrams shall be submitted to the SEPTA Project Manager.

1.03 PREREQUISITES TO SUBSTANTIAL COMPLETION

A. Complete the following before requesting SEPTA’s inspection for certification of substantial completion, for the work of the Contract. List known exceptions in the request.

1. Substantial completion is defined as follows:

a. The Contractor-installed system is tested, validated, and in-service, which is 100% functional in accordance with the intent of the design.

b. A punch list has been created of all outstanding design, installation and Contractual issues that both the Contractor and the SEPTA Project Manager have agreed to as being complete and without error.

c. The Contractor has provided all staging materials, programming tools, test equipment and diagnostic tools as detailed within the specifications.

2. In the progress payment request that coincides with, or is the first request following the date substantial completion is claimed, show either 100 percent completion for the portion of the Work claimed as "substantially complete," or list incomplete items, the value of incomplete Work, and reasons for the Work being incomplete. Include supporting documentation for completion as indicated in these Contract Documents.

3. Submit written certification to the SEPTA Project Manager that the project, or designated portion thereof, is substantially complete.
4. Submit list of items to be completed or corrected and material delivery dates of major items, as applicable.

5. Advise the SEPTA Project Manager of pending insurance changeover requirements.

6. All project record documents, maintenance manuals, warranties, and bonds shall be submitted as defined in Specification in Section 01720, “Project Record Documents”.

7. Obtain and submit releases enabling SEPTA's full, unrestricted use of the Work and access to services and utilities.

8. All demonstration and startup testing of equipment and systems is complete as specified in these Specifications.

9. All operations and maintenance manuals and instructions for SEPTA's personnel shall be completed as defined in Specification Section 01730 “Contractor Training Program”.

10. Discontinue and remove temporary facilities and services, restore the surroundings to their prior condition, as directed by the SEPTA Project Manager and specified herein along with construction tools and facilities, mockups, and similar elements.

11. Touch up and otherwise repair and restore marred exposed finishes.

B. Inspection Procedures

1. Upon receipt of the Contractor's request and submittal for inspection, the SEPTA Project Manager will either proceed with inspection or advise the Contractor of unresolved prerequisites.

2. Following the initial inspection, the SEPTA Project Manager will either prepare the certificate of substantial completion or will advise the Contractor of work which must be performed before the certificate will be issued. The SEPTA Project Manager will repeat the inspection when requested and when assured that the Work has been substantially completed.

3. Results of the completed inspection shall form the initial "punch list" for final acceptance.

4. The "punch list" shall include a reasonable time period to effectuate the work which is mutually agreed-upon by all parties.

1.04 PREREQUISITES TO FINAL ACCEPTANCE

A. General
1. Complete the following before requesting the SEPTA Project Manager's final inspection for certification of final acceptance and final payment as required by the Agreement. List known exceptions, if any, in the request.

   a. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

   b. Submit an updated final statement to account for final additional changes to the Contract sum.

   c. The Contractor has provided all configuration management documentation and validate that all equipment has been installed with the latest version of software and hardware.

2. Submit a Certified copy of the SEPTA Project Manager's final "punch list" which documents all work which has been completed.

3. Submit consent of surety.

4. Submit evidence of final, continuing insurance coverage, which complies with insurance requirements.

5. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.

B. Re-inspection Procedure

   1. The SEPTA Project Manager will re-inspect the Work upon receipt of the Contractor's notice that the Work, including "punch list" items resulting from earlier inspections, has been completed except for those items whose completion has been delayed because of circumstances that are acceptable to the Project Manager.

   2. Upon completion of re-inspection, the SEPTA Project Manager will either prepare a certificate of final acceptance or will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but which are required for final acceptance.

   3. If necessary, the re-inspection procedure will be repeated.

1.05 GUARANTEES, WARRANTIES, BONDS

   A. Submit three copies of all guarantees, warranties, and bonds to the SEPTA Project Manager prior to receipt of final payment, for all of the work, materials, and equipment provided under this Contract.

   B. The effective time limits of all guarantees and warranties shall commence on the date of Final Acceptance.
C. Refer to specifications for specific items covered by special guarantee or warranty.

1.06 PROJECT CLOSEOUT

A. Project Conditions

1. Leave the premises ready for use and occupancy without the need for further cleaning of any kind.

2. Remove all tools, appliances, project signs, materials, and equipment.

3. Leave work in proper condition and in proper adjustment

B. Furnish Closeout Documentation including:

1. Specific guarantees for materials and equipment

2. All certificates obtained in connection with the Work

3. Affidavit of Payment Debts and Claims

4. Affidavit Release of liens

5. Consent of Surety Co. to Final Payment

6. Maintenance Bond

7. Field books

8. Final Certificates of labor wages

9. Quality control records and test results

10. Maintenance Manuals

11. Fulfill all warranty provisions to SEPTA’s satisfaction

C. All forms shall be signed and notarized prior to submittal.

D. Final Inspection

1. Verify completion of punch list items.

2. Deliver a USB memory stick containing all submittals and project correspondence since project inception.

1.07 INSTRUCTION

A. Instruct SEPTA maintenance personnel in operation, installation, and maintenance of all mechanical and electrical systems and other equipment. Furnish letter to SEPTA
with copy to the SEPTA Project Manager, attesting to the names of persons receiving instructions and the dates instruction took place.

1.08 FINAL APPLICATION FOR PAYMENT

A. Submit final application in accordance with requirements of the Agreement.

1.09 POST-CONSTRUCTION INSPECTION

A. Prior to expiration of one year from Date of Final Acceptance, the SEPTA Project Manager will make visual inspection of Project in company of the Contractor to determine whether correction of Work is required, in accordance with provisions of the Agreement.

B. For Guarantees beyond one year, SEPTA/Project Manager will make inspections after notification to Contractor.

C. The SEPTA Project Manager will promptly notify Contractor, in writing, of any observed deficiencies.
SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies the requirements for maintenance and preparation of the Project Record Copy Drawings and the preparation of the "As-Builts" in addition to those requirements specified elsewhere in these specifications and the agreement.

B. The Contractor shall ensure all records are captured in a formal Records Management System that shall be made available to the SEPTA Project Manager and the Engineer.

1. The capture of project records:
   a. Ensures accountability through the documentation of stages, variations and approvals
   b. Allows for ready access to critical information during the project, such as risk mitigation strategies, litigations, and audits
   c. Provides an important resource for future maintenance and other projects

1.02 GENERAL REQUIREMENTS

A. Protect documents from the following; deterioration and loss of data, fire-resistant location; and provide safe access to record documents.

B. During the progress of the work, keep a master set of prints at the jobsite and identify the set of prints as "record copy" drawings; on which, keep a careful and net record of all deviations from the approved Contract Drawings, which may occur in the work as actually constructed.

C. Enter such changes and corrections in a clear and neat manner and include notification of same in the job meeting discussions for the record.

1. These changes shall be entered regularly as they occur, and the "record copy" drawings shall be presented to the SEPTA Project Manager for review upon request on a regular basis.

2. The Contractor shall have a draftsperson and other support personnel assigned uniquely to this Project as necessary to comply with the provisions of this section.

D. Indicate on the "AS-BUILT" drawings and in addition to all changes and corrections, the actual location of equipment installed by this Contract.
E. The Contractor shall deliver AutoCAD drawing electronic files and ten paper copies of the “Record Copy Drawings” to the SEPTA Project Manager at or prior to substantial completion.

F. The Contractor shall deliver vehicle “As-Built” 3D model drawings in AutoCAD format as well as “native, IGES or STEP” format. The Contractor shall furnish additional CAD drawings in AutoCAD format when the "as-built" changes cannot be readily or completely shown on the "As-Built" drawings. The Contractor shall correct the original plan sheets to reflect the as-built conditions. The Contractor shall furnish all CAD drawings in the version of AutoCAD that SEPTA is using at the time of Substantial Completion. The Contractor shall request this information from the SEPTA Project Manager prior to submission of the drawings.

G. The Contractor shall deliver electronic files and paper copies for the most recent revision of user-defined software in routers, Ethernet switches, communications managers and all processor systems installed at the Control Center, in the Vehicle, and in Radio Instrument Houses. All manuals and the product submittals shall be delivered on USB memory stick in accordance with the Submittals Section 01300, “Submittals”. Format shall be as approved by SEPTA.

H. The drafting work shall conform to acceptable standards for clarity and consistency, and shall be of the utmost quality and accuracy.

I. SEPTA shall provide the Contractor with a typical title block for the as-built drawings. “As-built” drawings shall be numbered by location with each location having a cover sheet, revision block and index, etc.

J. Final acceptance of the work and full payment will be contingent upon SEPTA’s acceptance of the "As-Built" drawings, software and hardware configurations. SEPTA shall have the right to reject unacceptable work and the Contractor shall remedy the same at no additional cost to SEPTA.

1.03 RECORDS MANAGEMENT SYSTEM

A. The Contractor shall provide a Records Management Program. All aspects of the program are subject to formal audit. Initial audit will establish action plans and specifications for implementation. Once records management systems are implemented, an ongoing continuous assessment cycle will be established through a program of self-assessment and formal audits.

1. Assessment criteria include:
   a. Staff awareness
   b. Responsibilities
   c. File creation and management
B. Documentation of all of the Contractor’s design and construction activities shall be captured in the Records Management System files to include but not be limited to the following:

a. All official correspondence, between all parties including email correspondence. This is to include correspondence between the Contractor and their Sub-Contractors, Contractor and the SEPTA Project Manager and Contractor and the Engineer.

b. All minutes and notes of project meetings including any handouts from the meeting.

c. Stakeholder contact details

d. Project brief/proposal/approval

e. All Requests for Information and responses to these requests/decisions made

f. All Change Order Requests and response correspondence

g. Test Plans and results, Verification and Validation Plans and Reports

h. Safety Plans and Reports

i. Project Status reports

j. Baseline CPM Schedule and all Monthly Updates

k. All payment requests and correspondence

l. Procurement documents

m. Instructions, direction, advice issued, and file notes

n. All As-Built Drawings

o. All hardware and software design documents
p. Project diary (where applicable)

q. Contracts with any external organizations (Configuration management Plan (CMP))

2. With projects, there are usually many versions of official documentation. Version control of these documents is essential. To maintain version control, the Contractor shall submit a Records Management Plan to the SEPTA Project Manager for approval, which includes the name of the project, software to be used, revision number, date of the revision, author, and where the electronic copy is stored and maintained.

PART 2 – PRODUCTS - NOT APPLICABLE

PART 3 – EXECUTION - NOT APPLICABLE

END OF SECTION
SECTION 01730

CONTRACTOR TRAINING PROGRAM

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This section specifies the Contractor’s requirements for the provision of a complete and all-encompassing training program for the SEPTA CARD System. This section also specifies requirements for the provision of Operation and Maintenance (O&M) Manuals for the SEPTA CARD System.

B. The Contractor shall develop and provide an operation, installation, and maintenance training program for SEPTA personnel as specified herein. Training of all SEPTA personnel as herein specified shall be completed in accordance with the approved CARD System project schedule. Generally, training shall be completed before the CARD System is placed into revenue service.

1. Classroom instruction shall be designed to cover, in detail, the functions of each subsystem including the interrelationships of the sub-systems. Fault isolation and troubleshooting techniques shall be covered to the extent necessary in preparation for maintenance laboratory instruction and shall be designed to provide SEPTA engineering and maintenance personnel with practical experience in the performance of preventive and corrective maintenance, including routine servicing. Troubleshooting and fault isolation of simulated faults shall be provided for each subsystem.

2. Simulations: Troubleshooting and fault isolation of simulated faults shall be provided for each subsystem including all special test equipment provided. The maintenance laboratory instructions shall be designed to conclude with a dynamic system fault isolation exercise.

C. Provide Training Program and materials, for all employees who will interface with this technology.

D. The Training Program shall employ a combination of formal classroom instruction and "hands-on" training using either actual system equipment or subsystems or components (subsets) to allow the introduction of faults, fault diagnosis procedures and repair techniques. The use of “hands on” equipment shall not include systems in-service. The Program shall be based on the use of the publications concerning the system specified here-in as the central source of information to SEPTA's personnel. No other printed matter may be used, except as approved by the SEPTA Project Manager.

E. Classroom instruction shall be presented utilizing Web-based training aids, Power Point presentations, and video sessions. Presentations and training materials shall utilize oversize diagrams from the actual O&M Manuals, as well as actual equipment models and mock-ups. Upon completion of the training, the student shall not only have a basic understanding of the subject matter, but shall also be well versed in how to obtain any needed information from the training publications. Hands-on training shall target 75 percent of the classroom instructional hours. Training shall be based on
equipment, functions, tasks and target audience.

F. Training Program Courses shall consist of a series of instructional classes for each system, topic or craft, as applicable. Training shall be organized into eight (8) hour classes. Instruction shall include the functionality of each system, sub-system, assembly, and sub-assembly, and the essentials of their operation and maintenance, as appropriate.

G. A Lesson Plan shall be developed for each unit of instruction, whether conducted in the classroom or field, and shall include the following:

1. Student prerequisites, including SEPTA craft or job category, prior knowledge, and skills;
2. Measurable learning objectives;
3. Material shall cover safety considerations and fault isolation;
4. Time frames for instructional units of the lesson;
5. Lists of training aids and other training technology;
6. Set-up time and lists of equipment for hands-on sessions;
7. Safety, protective equipment and hazards;
8. Instructor preparation;
9. Student preparation;
10. Evaluation of students (tests);
11. Lesson summary;
12. Student application of material; and
13. Student assignments

H. For each course the Contractor shall furnish the following:

1. Instructor Guides in three ring binders containing a series of Lesson Plans covering all training material for the complete course, divided into class topics and individual presentation units. The guides shall include:
   a. Table of Contents: providing a breakdown and listing of all topics contained in the instruction guide.
   b. Introduction: including course outline, purpose, objective, and testing and evaluation procedures.
   c. Class Instructions: for each unit of instruction, including all information necessary for presentation to the class in a logical, systematic approach,
including purpose, objectives, student material and handouts, tests and evaluations, administration requirements, time frames, and lesson plans. Class instructions shall explain how best to integrate audio/visual aids and other training technology into each Lesson Plan.

d. Student Guide Notations or Materials: instructors shall have notations on pages to indicate which ones are also provided in the Student Guides. Copies of materials provided to students shall be provided to instructors, where they differ from instructor materials.

e. Index: a complete list of training aids and training technology shall be provided, cross referenced to the Lesson Plan where they are used.

2. Each student shall be provided with a Student Guide in a three ring binder, which shall contain all classroom material required by the student for the course, divided into class topics and individual presentation units. The Student Guide shall contain materials necessary to allow for self-study.

3. Web-based training shall be provided along with handouts and mock-ups. Video presentations shall be on CD-ROM, with Universal Serial Bus (USB) memory stick master copies, and shall be approved by the SEPTA Project Manager. Closed-captioned versions of all video presentations shall be included. Classes shall be scheduled at SEPTA’s convenience and class size will be determined by the SEPTA Project Manager.

4. Training technology such as computer-based training, simulations and working mock-ups, shall consist primarily of realistic graphics with text only where required for labels or instructions.

I. The Training Program shall be conducted in English, and the Contractor's Instructors shall have a fluent command of the technical English language used in the transit industry in the US.

J. During each training subset, periodic written quizzes shall be given, concluding with a written final examination. Test content to be approved by SEPTA Project Manager. Those personnel not showing an understanding of the material, as determined by test scores, shall repeat the subject or subset area found deficient.

K. If an excessive number of personnel (as determined by the SEPTA Project Manager) fail to pass a particular training subset, the Contractor shall investigate the areas in which personnel have shown weaknesses, and revise the training subset to provide more effective training in these areas, while not exceeding normal industry minimum levels of education. Upon the conclusion of each training subset, the Contractor shall have all participants fill out a questionnaire concerning the Program's strong and weak points, and suggestions for improvement. These suggestions shall be incorporated, as appropriate, into the Training Program.

L. The Instructors used by the Contractor shall be familiar with SEPTA and its operations to a degree appropriate for the particular material being presented, be completely knowledgeable on the specific topic/equipment being presented, have full understanding of the hardware and software interfaces of the equipment and software
being presented, and be experienced trainers trained in adult education training techniques.

M. The Contractor shall provide all necessary audio-visual aids such as projectors, computer screens, Power Point presentations, testing equipment, mock-ups, etc. necessary to present the course material. Instructors shall be qualified to teach the required course. The SEPTA Project Manager reserves the right to check the qualifications and/or references of the proposed Instructors and also to reject for cause any Instructor not believed to be adequately qualified.

N. Formal classroom instruction shall be conducted in a suitable classrooms furnished by SEPTA.

O. The Contractor shall provide mock-ups of various system components, as agreed to by the SEPTA Project Manager. Instructional aides such as test equipment, mock-ups, training units, models and training technology such as computers, software and overhead projection panels shall be used in the presentation of the training program and/or for hands-on demonstration and training; and shall be furnished to the SEPTA Project Manager upon completion of the program.

P. The Contractor shall present a proposed list of instructional aides, mock-ups, or technical support equipment to the SEPTA Project Manager for approval and must take the responsibility for assuring that the defined training aids are available for use in the training. These items may make use of SEPTA's pool of parts provided that at least two parts of the type to be used are available. In addition, the Contractor shall supply enlarged wall charts suitable for classroom use of diagrams and schematics from the publications depicting the various sub-systems.

Q. The Contractor shall update all instruction material upon completion of the warranty period to cover any changes or retrofits to the systems performed after delivery. Any inconsistency or incorrect information uncovered during the instruction period must be immediately corrected and formally submitted to the SEPTA Project Manager in the form of replacement drawings, textual materials, video tapes, lesson plans, mock-ups, schematics and changes in documentation provided to the students.

R. At the conclusion of this training program, all training materials used shall become the property of SEPTA.

1.02 TRAINING HOURS

A. All instruction shall be conducted according to SEPTA schedules for a 3 shift, 7 day a week operation, except on SEPTA holidays. The Training Program shall be designed around SEPTA's ability to provide personnel for training during their regular shifts, and at quantities convenient for SEPTA's staffing needs. Class sizes shall be a minimum of ten (10) to not exceeding 20 employees and shall be as permitted by the SEPTA Project Manager. To match the shifts that SEPTA personnel work, the Contractor’s training staff shall be required to provide employee training classes on all three shifts, on all the days of the week including weekends. Scheduling of all training modules shall be at times and locations that are convenient to the SEPTA Project Manager.

1.03 ORGANIZATION
A. The Training Program shall be organized in parts as specified herein. Each part shall contain modules consisting of individual elements (subsets) assembled as necessary to fit its needs. The training program shall be organized into modules to target different personnel and departments. The Contractor may propose additional areas for the Training Program, subject to the SEPTA Project Manager’s approval.

B. Prior to commencing each individual training course, the Contractor shall provide the training to select supervisory personnel of the craft to be trained. The objective is for the respective craft management to critique and make adjustments to the course or presentation prior to training the entire craft. The contractor shall make all modifications to the course as directed by SEPTA Project Manager.

1.04 CONTINUING EDUCATION

A. The Sub-Contractor shall grant SEPTA the right to videotape all Training Programs, which is expected to be limited to classroom sessions, or hands-on training for future SEPTA training use.

1.06 QUALITY ASSURANCE

A. Review all data supplied by product manufacturers and installers for accuracy, completeness, and clarity prior to submittal to the SEPTA Project Manager.

B. When it is necessary that the Contractor prepare the text data required by this Section, it shall be their responsibility to ensure that the personnel preparing such data:

1. Have a thorough understanding of the operation and maintenance of the described items

2. Are sufficiently skilled in technical writing to communicate the essential data

C. Provide qualified instructors, professional training personnel, and Design Engineers who are thoroughly familiar with all subject material for each training session, and are of exceptional ability to allow the continuous extension of information to the student without a loss in expertise.

1.07 SUBMITTALS

A. The Contractor shall submit to the SEPTA Project Manager for approval not less than eight (8) months after Notice to Proceed (NTP) a detailed outline and schedule of the overall Training Program. This submittal shall include the hours of classroom and "hands-on" training projected per course, final course content, the qualifications of the Instructors, a listing of training aids to be used and a description of the scope of instruction, on an individual subset level, to fulfill the program requirements. It shall also include the questions proposed to be included in all tests.

B. Submit operation, installation, parts catalogs, and maintenance manuals for the CARD system and equipment items. Submittal shall be made in electronic version and in hard copies as follows:
1. Ten (10) copies of sample format and outline of training program contents in draft form with the equipment drawings for comment.

2. Ten (10) copies of proposed student manuals for comment.

3. Ten (10) copies of the outlines and manuals including SEPTA comments for approval prior to commencing training sessions

C. The Contractor shall submit the following to the SEPTA Project Manager for review and approval:

1. Training program plan
2. Training program schedule
3. Training program location
4. Instructor's names and qualifications
5. Instructor materials
6. Student materials
7. Training records

D. The following Training Program items are to be submitted to the SEPTA Project Manager for approval prior to the start of training:

1. Provide Program Outline, delineating the presentation for each system, as well as detailing topic(s) within each system and their planned time durations. Draft Lesson Plans
2. Draft Instructor Guides, including all training aids, such as handouts, overheads, slides, and sample video tapes and outlines or story boards
3. Draft Student Guides
4. Word Format version on CD-ROM of computer-based training technology and the hardware and software required to test them
5. Instructor Resumes
6. All Training program materials shall be submitted in both hard copy and electronic versions.

E. Training Program Plan - The plan shall be prepared in narrative form and shall be supported by such tables, charts, schedules, and graphs as are necessary to fully convey and describe the Contractor's plan for accomplishing the training set forth herein.

G. Training Program Schedule - The schedule shall show all major training activities in chart form, including submittal of instructor and student materials and training reports. The schedule shall be supported by such narrative description as is necessary to fully
convey its impact and relationship to other contract events, including installation and testing of such system equipment as is necessary for training laboratory sessions.

H. Instructor Materials - The Contractor shall submit three copies of instructor materials, except training aids, in accordance with the training program schedule, as approved by the SEPTA Project Manager, provided that such submittals shall occur at an approved time prior to the scheduled commencement date of the first training session to which the materials apply.

I. Student Materials - The Contractor shall submit three copies of student materials in accordance with the training program schedule, as approved by the SEPTA Project Manager, provided that such submittals shall occur at an approved time prior to commencement of the first training session to which the materials apply. The student materials shall include a printed copy of all visual training aids to be used by the instructor.

J. Training Records - The Contractor shall submit three copies of training records in accordance with the training program schedule, provided that each report submittal shall occur at an approved time following the last day of the training session to which the record applies.

PART 2 - PRODUCTS

2.01 MANUAL REQUIREMENTS

A. All operations and maintenance training manuals shall be sufficiently detailed so as to enable the respective technicians / operators to operate, manipulate, inspect, maintain, repair, overhaul, calibrate, test, re-configure, revise and service the new systems to be provided.

B. Material shall be in sufficient detail and form for easy use. The material in the manuals and parts catalog shall be organized and sequenced. Manual format throughout each set of documents shall be consistent in approach. Where provided, sharp, clear drawings shall be used throughout the documents for illustration. Photographs may be used only where explicitly approved by the SEPTA Project Manager. All publications must be reviewed in detail by the Contractor to ensure completeness, accuracy, presentation and content of information and quality prior to any submittal to the SEPTA Project Manager for approval.

C. Requirements for Manuals

1. Manuals furnished may be manufacturer's standard publications in regard to size and binding provided they comply with specified requirements relative to quantity and quality of information and data.

2. Bind manuals within hard or flexible covers. Make illustrations clear, and printed matter, including dimensions and lettering on drawings, easily legible. If reduced drawings are incorporated into manuals, heavy-up original lines and letters as necessary to retain their legibility after reduction. Larger drawings may be folded into manuals to page size.
3. Clearly identify each manual through the front cover with at least the following information:

   (*description of manual) (Description of equipment or systems)

   SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY

   (Name of Contractor)

   Approved by: (SEPTA Project Manager Signature) Date: ____________

D. Hard Copy Manuals

1. All hard copies of the manuals shall use a loose-leaf format using high grade paper conforming to ATA Specification 101 with five punch holes. Diagrams shall not be loose or in pockets. Line drawings are to be in reduced size. All publication covers shall be loose-leaf binders, oil resistant, moisture proof and resistant to wear, ViaTech Publishing Solutions, or approved equal, with the following specifics:

   a. 122pt Unitized Board

   b. White Premahyde outer covering

   c. Black Skytogen lining

   d. 5-prong swing metal Hinge.

2. The binder color and wording shall be as specified by the SEPTA Project Manager. All documents shall be 8.5 inches wide by 11 inches high, vertical format. Plastic coated tabs shall be used to segregate sections within each publication.

3. It is SEPTA's intent to have totally updated published versions of the manuals and parts catalogs, free of the need for updating inserts as possible. Up-to-date published manuals shall be scheduled for delivery at the time of acceptance of each CARD sub-system.

E. Format Manuals as follows:

1. Title page: Include the name and function of the equipment, manufacturer's identification number.

2. Provide Table of contents, in numerical order listing all sections and subsection titles of the Manuals with reference to the page on which each starts and a list of included diagrams and drawings. A complete page-numbered index shall be provided at the end of each manual.

3. Provide acronyms, abbreviations and definitions

4. Provide a Safety Summary

5. Provide introduction, which incorporates system overview, system configurations, general system operation and specifications.
6. Provide familiarization by describing each piece of equipment, including major assemblies and sub-assemblies, and giving manufacturer's model number and drawing number.

7. Provide functional description including step-by-step preparation for the following:
   a. Sequence of operation
   b. User interfaces
   c. Procedures and adjustments
   d. Maintenance
   e. Troubleshooting
   f. Installation

8. Provide typical wiring diagrams, control diagrams, troubleshooting flowcharts, and event / diagnostic charts.

9. Maintenance schedule to include type and frequency of each maintenance item for each system and piece of equipment.

10. Maintenance instruction: Include step-by-step procedures for inspection, operation checks, cleaning, adjustments, repair, overhaul, disassembly, and reassembly of the equipment for proper operation of the equipment. Include list of special tools which are required for maintenance with the maintenance information.

11. Breakdowns, repairs, and troubleshooting

12. Manufacturer's parts list of all functional components, control diagrams and wiring diagrams, giving manufacturer's model number and manufacturer's part number.

13. Appendix: Include safety precautions, a glossary, and, if available at time of submittal, copies of test reports, and other relevant material not specified to be submitted.

F. Electronic Manual Format and Copies

1. The Contractor shall provide electronic copies of all manuals and the Parts Catalogs. Copies of all graphics, pictures and illustrations shall also be provided separately in high-resolution formats. Formats shall be suitable for their type, such as BMP for graphics and TIFF for monochrome black-line illustrations. In addition to the authoring documents, all publications shall be distilled into Adobe PDF format.

2. Manual information shall be kept up-to-date during the full extent of the Contract. As information becomes available and changes occur, the Contractor shall incorporate the changes and supply the information for additions to the respective employees training manuals. The Contractor shall provide the revised sheets /copies for the employees to insert into their manuals. The Contractor shall
maintain a revision log of all revised sheets sent out to field personnel to the end of the project at which time the Contractor shall provide electronic copies of all finalized training and operations documentations as approved by the SEPTA Project Manager. Each updated information submittal shall be accompanied by a file containing a revised List of Effected Pages for the manual set being changed.

2.04 ELECTRONIC MEDIA SUBMITTAL

A. The Contractor shall also provide all publications, manuals, software documentation, software, etc. to SEPTA on SEPTA-approved electronic media to be used on Windows TM compatible personal computers.

B. Three fully licensed copies for SEPTA usage during the life of the equipment of all software needed to view and edit the manuals in the future are also to be provided to SEPTA. These CD-ROM or other approved media files shall be both comprehensive and complete.

C. With these files, together with the provided software used to create the publications, SEPTA shall have the ability to revise and reissue changes to all of the equipment publications for the life of the CARD system, following the conclusion of the warranty.

PART 3 – EXECUTION

3.01 TRAINING PROGRAM EFFECTIVENESS EVALUATION

A. The primary objective of the training is to convey to the students that information which the students need to operate and maintain CARD system. To assess the effectiveness of the training program, evaluation capabilities shall be built into each course, at least once within each major topic or system. These evaluation capabilities shall be in a form that provides quantified results on an individual student basis.

B. Results of the effectiveness evaluation of student learning are to be evaluated to determine what, if anything needs to be done to improve upon how the course matter is being presented and assimilated by the students.

END OF SECTION
SECTION 02050

DESTRUCTION AND REMOVALS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Demolition work includes removal of all retired equipment, systems, devices, or infrastructure required by the work performed under this Contract. This is to include removal of equipment that may interfere with the installation of new construction work, whether or not indicated on the Contract Drawings or specified herein.

B. 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 SEPTA Project Manager prior to demolition.

C. The Contractor shall remove all retired equipment, to include but not be limited to the following:

   1. Vehicle Equipment.
   2. Control Center Equipment

D. Coordinate schedule with utility companies, so as to maintain utility services.

1.02 QUALITY ASSURANCE A. Demolition

1. Demolish equipment as described herein, and remove debris from the site. Use such methods as required to complete the work within the limitations of governing regulations.

2. Contractor shall immediately notify SEPTA of any damaged equipment and confirm damage in writing within 24 hours.

B. Pollution Controls

1. Comply with governing regulations pertaining to environmental protection.

2. 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.

1.03 SUBMITTALS

A. Permits

1. Obtain permits, as required from all local municipalities, utility companies and the City of Philadelphia, Department of Licenses and Inspections.

2. Furnish the SEPTA 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 SEPTA 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 DELIVERY

A. The Contractor shall return all equipment determined to be salvageable by the SEPTA Project Manager to a location to be determined by the SEPTA Project Manager. Obtain written receipt from SEPTA as proof of delivery for each item transferred to SEPTA.

B. The Contractor shall store all salvageable items as described above in a secure area until notification by the SEPTA Project Manager to deliver said items to an approved storage facility.

C. Those items deemed salvageable by the SEPTA Project Manager, that are damaged by Contractor during removal, demolition, storage and delivery shall be replaced with an item of equal or same function at no additional cost to SEPTA.

D. Those items deemed unsalvageable by the SEPTA Project Manager shall be disposed of by the Contractor at no additional cost to SEPTA.

E. The Contractor shall dispose of all removed or retired equipment unless otherwise directed by SEPTA.

1.05 JOB CONDITIONS

A. Occupancy

1. Safety of SEPTA operations, patrons and employees is paramount. Demolition work which would interfere with or be hazardous to the operation of trains, passengers or local residents shall occur at a time and or during an approved shutdown or outage periods.

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

3. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities as directed in, Section 01100 ‘Special Project Procedures”, and Section 01060 “Regulatory Requirements and Safety”.

B. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to the existing station platforms, adjacent buildings, structures, other facilities, and persons.

1. Erect temporary covered passageways as required by authorities having jurisdiction.
2. Provide shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities remain.

3. Furnish and maintain temporary signs, barricades, flashing lights and flagman, if required by the work, or as directed by SEPTA’s Project Manager and remove same upon completion of the work.

C. Damages

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

D. Utility Services

1. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

2. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction.

PART 2 - PRODUCTS PART 3 - EXECUTION

3.01 INSTALLATION

A. Electrical Demolition

1. Demolish equipment as shown on drawings and described herein, and remove debris from the site.

2. Coordinate removal of telephone, telegraph and communication facilities with the affected utility.

3. All expenses incurred by the Contractor from utility agencies in the removal or modifications of their facilities shall be paid by the Contractor.

3.02 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 SEPTA Project Manager notified if adjacent structures appear to be in danger. Demolition shall not resume until directed in writing by the SEPTA Project Manager.

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

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

B. Use 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.

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

D. 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 SEPTA Project Manager and approved by the authorities having jurisdiction.

3.04 DISPOSAL OF DEMOLISHED MATERIALS

A. Contractor shall be responsible for the proper disposal of all materials.

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

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

D. Transport demolished materials and dispose of them off the site.

E. 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 SEPTA Project Manager for review.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section specifies the furnishing of all labor, material and equipment for locating signal conduit, and for excavation, trenching, backfilling and compaction for external cables and conduits, and for foundations for Radio Instrument House (RIH), wooden poles, antenna poles, fence posts, and all other signal and communications facilities at the various locations indicated on the Contract Drawings and as directed by the SEPTA Project Manager.

B. Rock excavation, if encountered, shall be included with excavation in this section, and is defined as the removal and disposal of materials in place which cannot be loosened or broken down by ripping, with the use of modern construction earth excavating equipment, and which requires special rock excavation equipment for its removal. This shall include boulders measuring one-half cubic yard or more and all solid-rock masonry, and plain or reinforced concrete pavements, which require the use of hand power tools such as jackhammers or paving breakers.

C. After all excavation, instrument housings, equipment are installed the site shall be graded to have no holes or tripping hazards. In addition, the Contractor shall provide and install 3/4” clean crushed stone around the entire job site.

D. All RIHs are to be installed with a maximum rise of eight (8) inches from grade to the floor.

E. Sheetinng and shoring of excavated areas and trenches shall be included as necessary for the work described herein, at no additional cost to SEPTA. Plans for this work shall be submitted to the SEPTA Project Manager for approval.

F. Dewatering of excavated areas, conduit, ducts, manholes and pull chambers shall be included as necessary for the work described herein, at no additional cost to SEPTA.

G. Backfill materials shall consist of the following:

1. For foundations, crushed stone shall be used for the base to the limits specified herein. Suitable onsite earth excavation material or gravel material may be used for backfill beyond the specified limits for crushed stone.

2. For cable trench excavations, sand bedding shall be used for direct burial cable to the limits specified herein. Suitable onsite earth excavation material or gravel may be used for backfill beyond the specified limits for sand bedding.

3. The suitability of all backfill material shall be as specified herein, and subject to the approval of the SEPTA Project Manager.

1.02 SITE PREPARATION
A. The Contractor shall be responsible to have all underground utilities located and marked, which includes SEPTA, 30 days prior to actual excavation.

B. The Contractor shall assure that all excavation is accomplished on SEPTA property

C. If excavation is done within 15’ of the nearest centerline of any track, the Contractor shall arrange for flag protection.

D. The Contractor shall plan and perform any excavation with no impact to train operations.

E. The Contractor shall evaluate the location of RIHs and cable paths based on the Contract Drawings and the information provided above. Determine the appropriate path to excavate or trench the cables into the RIH, CIL, Antenna structure, and power drops.

1.03 CLEARING AND GRUBBING

A. The Contractor shall clear all areas of brush, trees and any debris where the RIH, antenna, and power drops are to be located and excavation of cables. The removal of debris shall be properly discarded, ground up, or otherwise directed by SEPTA.

B. The Contractor shall be responsible to trim trees as required for clearances of the installed antennas.

1.04 QUALITY ASSURANCE

A. The Contractor shall request and obtain the SEPTA Project Manager’s approval for onsite or offsite excavated materials to be used as backfill material prior to cable or conduit placement. Upon request of SEPTA, the Contractor shall arrange for analyses and certifications of such material at no additional expense to SEPTA.

1.05 JOB CONDITIONS

A. Sheeting and shoring of trenches and foundation excavations shall be as required for material support and safety precautions.

B. Transportation of backfill materials and dust control shall be in compliance with applicable environmental codes and regulations. Mechanical or manual sweeping of public roads and streets shall be provided to remove soil deposited by all vehicles carrying material.

C. Information will be provided by SEPTA concerning the location of existing signal conduit, manholes and duct banks. The Contractor shall furnish all labor, equipment and material required to alter his trench layout wherever necessary to accommodate the locations of existing conduits, ducts, manholes and other underground facilities. The Contractor shall provide all labor, equipment and materials required to locate and excavate to these facilities in the field.

1.06 SUBMITTALS
A. The Contractor shall submit certification that all backfill material is in fact "clean fill" and does not contain waste materials or other pollutants.

B. The Contractor shall submit site plans showing all required vegetation removal and how it will be discarded for SEPTA approval.

C. The Contractor shall submit sheeting and shoring plans for all locations where these operations will take place.

1.07 DELIVERY

A. Backfill materials delivered to the site and excavated materials suitable for backfill shall be stored in areas designated by SEPTA and placed in neat piles which will not interfere with traffic movements and/or work being performed by other Contractors or SEPTA. Surplus excavated materials not required for backfill shall be removed from the site for disposal as soon as possible, unless otherwise directed by SEPTA.

PART 2 - PRODUCTS

2.01 MATERIAL A. Fill

1. The Contractor shall notify SEPTA at least ten days in advance of the purchase of offsite fill materials and shall designate the proposed borrow site locations in order that SEPTA may determine if analyses and certifications of the materials are necessary for "Quality Assurance."

2. Materials to be used as ordinary backfill under this Contract shall have physical characteristics of soils designated as group A-1, A-2-4 or A-3 under American Association of State Highway and Transportation Officials (AASHTO) M-145.

3. Sand for cable bedding shall consist of clean, inert, hard, durable grains of quartz or other hard, durable rock, free from loam or clay, surface coatings, and deleterious materials. The allowable amount of material passing a No. 200 sieve as determined by AASHTO T-11 shall not exceed ten percent by weight.

4. Gravel backfill shall consist of inert material that is hard, durable stone and coarse sand, free from loam or clay, surface coatings, and deleterious materials.
   a. 3/4” clean crushed stone base shall be used for all foundations.
   b. Replacement of excavated ballast shall be as specified by the SEPTA Project Manager.

2.02 CABLE MARKING

A. Trench Marker Tape

1. Trench marker tape shall be bright yellow polyethylene, six inches wide and continuously coded in black lettering with the following legend:
2. The tape shall be Type KB-720 as manufactured by W. H. Brady Co., or a SEPTA Project Manager approved equal.

PART 3 - EXECUTION

3.01 SITE PREPARATIONS

A. Remove and properly discard all vegetation and trees as required for each jobsite to install SEPTA CARD System equipment.

B. Clean 3/4” crushed rock shall be placed in the entire area within the fence and a minimum of 5 feet outside the fence. The crushed rock layer shall be a minimum of 4 inches thick and shall be furnished and installed by the Contractor.

3.02 BASIC EXCAVATION

A. All excavation shall be performed to the depths and widths specified. Over- excavation shall be kept to a minimum and any over-excavation below the required depths and/or greater than specified minimum width shall be replaced with backfill material meeting the specified requirements, at no additional cost to SEPTA.

B. The Contractor shall remove contaminated ballast and replace with clean ballast of the same type, which shall be placed and compacted in 6-inch lifts, where trenching is done under the main line tracks.

C. Soft or unsuitable material existing below the required sub-grade shall be removed and replaced with gravel, crushed stone, or other suitable material, as directed by the SEPTA Project Manager, and thoroughly compacted. Rock or boulders shall be removed below the sub-grade to a minimum depth of one foot below the bottom of the cable or foundation.

D. If cross pipes, drains, or other unforeseen obstacles are encountered during the excavation, the proposed line and grade of the cable or foundation may be altered with prior approval of SEPTA.

E. At any excavation beneath active track, or near tracks requiring sheeting, the Contractor shall notify the SEPTA Project Manager and submit for approval, drawings showing the proposed method of supporting the tracks. These drawings shall be sealed by a Professional Engineer registered in the State of Pennsylvania.

F. At locations under tracks, the minimum clearance from bottom of tie to top of underground conduits shall be thirty (30) inches.

END OF SECTION