SECTION 13570
BASIC REQUIREMENTS FOR SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. This Section describes the basic requirements and functionality for designing, furnishing, and installing the SEPTA Wayside System in support of the Communications Based Train Control (CBTC) and Centralized Traffic Control (CTC) systems as specified within these Specifications and the Contract Documents. The Media / Sharon Hill (MSHL) Trolley runs upon a dedicated ballasted right-of-way that is exclusively for the trolley except where the trolley is in street running at the Media terminus and in Clifton Heights where it shares the road with auto traffic. The track is non-standard 62½” gauge vs. 56½” standard. The existing signal system has intermittent block signaling capabilities with signals that predominantly deliver switch point detection. All the existing switches on the run line south of 69th Street Transportation Center in Upper Darby are auto-return spring switches. A single track section between Woodland Ave and Smedley Park is controlled by signals that display track occupancy when there is a train on the single track. The entire existing signal system will be retired by this project.

B. There are forty-seven (47) road crossings at grade that are to be interfaced with the CBTC and CTC systems. Thirty-four (34) Twenty-eight (28) of those crossings are controlled by an Ansaldo STS MicroLok II Vital Micro-Processor Interlocking System (VMIS) with either an inductive loop train detection system or an audio-frequency overlay (AFO) track circuit system. The Contractor shall interface to the existing VMIS in all such locations. Where there currently is no processor control of the crossings, the contractor shall utilize new MicroLok II’s as an interface to the CBTC and CTC systems. Where there is pre-emption to a Township-owned Traffic Light Controller, the interface shall be through a contact of a vital relay.

C. Refer to the Contract Drawings for further details on the existing signaling infrastructure.

1.02 DESCRIPTION

A. The system to be provided shall be designed with the primary focus on safety, availability, reliability and maintainability. However, the CBTC system shall also be designed with an emphasis on minimizing the effect on trolley operations to the extent required by SEPTA as a result of failures and or design permutations from the CBTC system. All conditions under which the CBTC software shall require a service brake to be automatically applied shall be identified by the Contractor during the design and be subject to the direction and or approval of the SEPTA Project Manager.
B. The basic requirements and design criteria of these Specifications and Contract Drawings are written to establish guidelines in providing equipment, material, hardware, and necessary appurtenances required by the work.

C. Design and workmanship of apparatus shall comply with the “Rules, Standards and Instructions for the Installation, Inspection, Maintenance, and Repair of Signal and Train Control Systems, Devices, and Appliances” as set forth by the Office of Safety of the FRA unless relief is granted in writing by the SEPTA Project Manager.

D. The Contractor shall design, furnish, and factory test the equipment to provide the highest degree of safety and reliability.

E. Unless otherwise specified herein, provide materials in accordance with applicable AREMA, IEEE, NEMA, FRA, and Authority standards, practices, and recommendations unless relief is granted in writing by the SEPTA Project Manager.

F. The Contractor shall provide fully detailed layout designs for each individual location required by the new system that meets the intent as illustrated by typical drawings included in the Contract Documents [CDRL 13570-001].

G. The Contractor shall design in detail, check and finalize the hardware design in accordance with the design intent for the proposed equipment. The Contractor shall provide all material and equipment whether or not specifically delineated but as may be required by the detailed design to provide a safe and workable system [CDRL 13570-002].

H. The Contract Drawings show the general arrangement of apparatus to be provided. Provide all material and appurtenances to ensure the installation of a fully-functional system as may be required in support of the CBTC – CTC system.

I. Provide factory wired and tested apparatus including; instrument housings, junction boxes, colorlight signals, traffic light signals, trolley light signals, local control panels, switch and lock movements, and other systems and devices as shown on the Contract Drawings and as indicated in these Specifications.

J. The Contractor shall provide an AREMA compliant train control system, which consists of vital microprocessor based logic system with interface circuits employed for interlocking status, traffic light control (where required) and the transmission of messages to the CBTC Region Controllers via the ground based network subsystem. The design shall include interfaces to new VMIS and Local Traffic Light Controllers (LTC) where required.

K. The Contractor shall provide an infrastructure asset management system, as approved by the project manager, capable of managing the physical hardware and software assets of the project. It shall include the management of the project life cycle (design, construction, commissioning, operating, maintaining, repairing,
modifying, replacing and decommissioning/disposal) of the hardware, software and infrastructure assets. [CDRL 13570-003]

L. In conjunction with the survey tasks outlined in section 01050 the Contractor shall perform a Geographic Information System (GIS) survey and provide a track database design layout to be used in the development of the CBTC track database [CDRL 13570-004]. As part of the CBTC system, a complete GPS survey of the trolley territories where CBTC equipment will be installed shall be performed. The survey must provide a horizontal accuracy of 0.3 meters and a vertical accuracy of 0.6 meters. The Contractor will be responsible for the completion of the survey and the creation of GIS databases. The survey shall identify the Latitude, Longitude and Chaining Stations for the following features.

1. Main Line Tracks
   a. Milepost Equations
2. Other Tracks leading into CBTC Territory
   a. Yard Limits
3. Milepost Markers
4. Track Centerlines
   a. Clearance Points
   b. Horizontal Curves
      1) Length of entry spiral
      2) Length of curve
      3) Length of exit spiral
      4) Degree of Curve
      5) Superelevation
5. Signals
   a. Interlocking
   b. Control Point
6. Turnouts
   a. Direction
   b. Facing
   c. Size
   d. Point of Switch
   e. Type of Switch
      1) Normal
      2) Spring
7. Time Table Speeds
8. Highway Grade Crossings
   a. Begin/End Latitude/Longitude.
b. Type of Crossing
   1) Public

9. Bridges
   a. Begin/End Latitude/Longitude
   b. Type of Bridge

10. Station Platforms (optional)

11. Bungalows, Cases, Antenna Towers (right of way)

12. Bumping Post

13. Other Wayside features as deemed necessary by SEPTA.

This processed data must be capable of being loaded into the CBTC data mapping system as required by the contractor.

The processed data must also be capable of being uploaded into an Asset Management System to be determined by SEPTA. All data and maps shall become the property of SEPTA.

Speed data will come from SEPTA’s Time Table and Special Instructions and General Orders.

M. All interfaces between Vital Microprocessor Equipment and LTC’s shall be by discrete outputs only.

N. All interlockings shall be provided with steady-energy AC track circuits.

O. New VMIS shall be provided for driving new electric power switches and LED type color light signals through vital relays.

P. All interlockings shall include supplementary systems such as snowmelters, fire and intrusion detection, standby power and other systems.

1.03 DELIVERABLES

A. Comply with pertinent provisions of Section 01050.

B. Contractors shall submit:

   1. Data demonstrating qualifications of persons proposed to be engaged for field engineering/survey services. [CDRL 01050-001]
   2. Documentation detailing the methods that the Contractor proposes to use to achieve and verify required survey accuracy. [CDRL 01050-002]
   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. [CDRL 13570-003] 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.

C. CDRLs

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<th>CDRL No.</th>
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<tr>
<td>CDRL 13570-001</td>
<td>Fully detailed layout designs for each individual location</td>
<td>1.03B.1</td>
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<tr>
<td>CDRL 13570-002</td>
<td>Fully detailed hardware designs for each individual location</td>
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<td>CDRL-13570-003</td>
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<tr>
<td>CDRL 13570-005</td>
<td>Vital equipment FMECA, FMEA, MTBF and other safety and reliability analysis</td>
<td>1.05D</td>
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1.04 SUMMARY OF WORK

A. Provide new remotely controlled instrument housings including vital and overlay track circuits, impedance bonds, electric switch and lock layouts, colorlight signals, snowmelter equipment, track wire junction boxes and all other equipment as shown on the Contract Drawings and as described within these specifications.

B. All new interlockings shall be interfaced to the CBTC system as described in this document.

1.05 QUALITY ASSURANCE

A. All wayside signal systems work shall comply with AREMA Signal Manual, SEPTA Standards C&S 1 and C&S 2 and the FRA “Rules, Standards, and Instructions for Railroad Signal Systems”, as they apply to the CBTC system, unless relief is granted in writing by the SEPTA Project Manager.

B. If a conflict exists between standards and regulations as specified herein, the opinion of the SEPTA Project Manager shall govern. Waivers to these standards shall be approved by the SEPTA Project Manager.

C. All VMIS equipment to be provided under this Contract shall be the Microlok II as manufactured by Ansaldo STS of Pittsburg, PA.

D. Where required by the SEPTA Project Manager, all vital circuit equipment shall be provided with an FMECA, FMEA, MTBF and other safety and reliability analysis attesting to each unit’s safe and reliable operation in 700 VDC traction power territory and any and all other documentation that the SEPTA Project Manager may require to substantiate the devices suitability for operation on the Media-Sharon Hill Line. [CDRL 13570-005].
E. All materials shall be as shown on the Contract Drawings and as described within these Specifications. Where no material specification has been provided, the Contractor shall submit for approval to the SEPTA Project Manager.

1.06 REFERENCE STANDARDS

A. The standards of AREMA Communications and Signals Division, National Electrical Manufacturers Association, Underwriter’s Laboratories, Institute of Electrical and Electronic Engineers, and SEPTA shall be adhered to in every instance where such standards have been established for the particular type of work, material, or equipment to be installed, except where such requirements conflict with this Specification unless relief is granted in writing by the SEPTA Project Manager.

B. Reference Standards: Pertinent provisions of the following listed standards shall apply to the work of this Specification, except as they may be modified herein, and are hereby made a part of this Specification where the requirements of the following do not conflict with this Section of the Specifications.

2. Institute of Electrical and Electronic Engineers Standard Dictionary of Electrical and Electronics Terms
3. In the event of a conflict between definitions, the opinion of the SEPTA Project manager shall govern

PART 2– PRODUCTS

2.01 GENERAL

A. Provide all material and apparatus as shown on the Contract Drawings.

B. Provide new products and components that are free of manufacturing defects. Provide electrical components rated to operate at power, voltage, current, frequency, and temperature levels, exceeding by 20%, those to which these components shall be subjected to when in service, unless otherwise specified herein.

2.02 EQUIPMENT AND ENVIRONMENT

A. Instrument housings

1. Provide equipment in instrument housings to function in accordance with these Specifications and within a temperature range of -22 degrees F to 158 degrees F at relative humidity of 0 percent to 95 percent.
2. Provide equipment for outside use to operate satisfactorily in weather conditions including rain, snow, dirt, temperature variations, and humidity
variations. In addition, follow recommendations of AREMA Signal Manual, Part 2.3.25 to minimize condensation and frost build-up.

B. Electric Environment:

1. Determine the electrical environment to which equipment will be exposed. Provide a signal system and equipment that performs satisfactorily in an electrified rail environment utilizing 700 VDC direct current propulsion power system.

2.03 DESIGN CRITERIA

A. General Design Requirements:

1. Contractor shall provide a fully detailed design for each location from the typical Contract Drawings. All designs shall be approved by the SEPTA Project Manager prior to commencing manufacture or material procurement. The detailed designs shall include, but not necessarily be limited to the following plans and drawings:
   a. Energy loops,
   b. Main terminal board,
   c. Relay and equipment rack layouts,
   d. Relay contact assignments
   e. Ground equipment wiring details,
   f. Input and output board assignments,
   g. Cable and wiring plans, and other detailed signaling drawings as required by the SEPTA Project Manager.

2. Command and control systems shall be centralized to the instrument housings. Those devices required to be deployed at outlying locations shall only be high reliability, discrete devices to minimize nuisance failures.

3. The Contractor shall provide detailed designs and shall provide all circuit plan wiring and circuit tagging with the appropriate circuit nomenclature.

4. The Contractor shall provide all repeater relays as required by the detailed design and as approved by the SEPTA Project Manager. All repeater relays shall be provided with a minimum of one (1) spare front/back combination from the same contact.

2.04 FAIL-SAFE DESIGN CRITERIA

A. The Contractor shall provide designs, materials and equipment that are failsafe and have a demonstrated history of reliability and maintainability in DC electrified territory under conditions as may be found along this Line. In preparing the design, the Contractor shall bring to the attention of the SEPTA Project Manager, any condition or situation that in their opinion, does not meet this criteria.
1. Design vital circuits based on fail-safe design practices and principles, i.e.: broken wires, damaged or dirty contacts, relay failing to respond when energized, or loss of power shall not result in an unsafe condition.

2. Design vital repeater relay circuits on the cascade principal. Paralleling of vital repeater relays is not allowed. Assign repeater relay contacts so safety is not compromised by failure of repeater relay to energize.

3. Double break vital circuits. Begin double break when circuit first leaves housing in which the coil is located and continues until positive and negative energy is reached.

4. Use contacts of each track relay solely to control its own first repeater relay.

5. Arrange relay circuits so heel of relay contact is connected towards circuit load, and front or back contact is connected towards energy source.

B. Vital Relay Control Circuits:

1. Provide vital control circuits based on closed circuit design principles with additional requirements as follows:
   a. No common return on open line wire;
   b. No polar relays;
   c. 12 VDC vital signal control circuits;
   d. All vital line circuits will be double broke.

C. Checking

1. All detailed designs shall be checked by a knowledgeable and qualified Contractor employee other than the original circuit designer who shall initial each drawing to indicate the circuit check has been made.

PART 3– EXECUTION

3.01 EXECUTION

A. The Contractor shall provide circuits based upon criteria identified herein and on the Contract Drawings. Provide detailed design and wiring drawings based on the Contract Drawings to perform the functions as shown.

B. When making revisions to existing drawing packages, circuits to be removed shall be designated by an X and circuits to be installed are to be designated by an O.
C. The Contractor shall re-design and renumber the Contract Drawings into complete design packages based on typical designs. The renumbering shall incorporate the existing grade crossing drawings plan numbering scheme without requiring the crossing plans to be renumbered. All interlockings shall be numbered in a logical order and approved by the SEPTA Project Manager. Where existing drawings do not exist, or are not in a CAD format, the contractor shall be required to provide new CAD drawings based upon the existing/revised circuits. Newly CADed drawings shall provide the same level of detail as the new drawings.

END OF SECTION 13570