SECTION 13594

CBTC OFFICE AND CONTROL CENTER REQUIREMENTS

PART 1 – GENERAL

1.01 OPERATIONAL AND MAINTENANCE CONTROL CENTER OVERVIEW

A. The function of the Operational Control Center (OCC) subsystem is to provide the primary Human Machine Interface (HMI) to the overall MSHL Communication Based Trolley Control (CBTC) System including but not limited to: providing typical Centralized Traffic Control (CTC) operations of interlockings and crossings including manual and automatic operations, trolley scheduling, event and alarm recording, systems performance and reporting functions. The CTC System shall be the supervisory system interfacing directly to the interlocking subsystem and the CBTC subsystem and shall provide other functions defined herein and as necessary based on the Contractor’s particular design. From the various OCC Dispatcher workstations, the Dispatcher and others shall be able to monitor and manage the overall operation of the entire MSHL CBTC System.

The OCC equipment shall be located on the 19th Floor at 1234 Market Street (primary) and Market Street East Platform (backup). Refer to Contract Drawings for room layouts. As shown on the Contract Communications Reference drawings, there is SEPTA-owned dark fiber between 1234 20th floor and the Market East computer room available for Contractor use.

B. The function of the Maintenance Control Center (MCC) subsystem is to provide the primary HMI to the CBTC System for maintenance, troubleshooting and data recording and analysis functions. In addition, the MCC workstations shall be capable of performing the functions of the OCC workstations during failure modes or when the OCC workstations are not usable.

The MCC equipment shall be located at the Fern Rock Maintenance Headquarters and the 103 Victory Avenue Maintenance Facility.

C. Office Equipment shall have a design life of fifteen years (15) unless otherwise noted.

D. Office equipment shall be provisioned within existing SEPTA office and equipment spaces. Refer to the Contract Drawings.

D. E. The Contractor shall utilize existing desks and racks for workstation installation.

1.02 OPERATIONAL CONTROL CENTER REQUIREMENTS

A. The OCC shall provide the following primary functions:
1. System overview and real time status display;
2. Trolley tracking;
3. Automatic and manual route setting;
4. Interlocking control;
5. Crossing override control;
6. Setting and clearing track and track object blocking;
7. Temporary speed restriction setting and clearing;
8. Data archiving, recording and playback;
9. Training and simulation;
10. Event and alarm monitoring for the entire MSHL System;
11. Other functions as required by a particular Contractor’s design.

B. The MSHL OCC function shall be performed at the current OCC located on the 19th Floor at 1234 Market Street (primary), at the EBCC located at Market Street East Platform (secondary). The MCC and individual Interlocking Local Control Panel (LCP)s are designed as maintenance and troubleshooting facilities and shall be capable of assuming operations of the MSHL in the event of a system-wide failure which renders the OCC/EBCC incapable of providing their designated functions. The term “OCC” shall be understood to refer to the collective equipment and function provided by the OCC, EBCC and MCC unless otherwise indicated.

C. Only the OCC, EBCC, or MCC shall be capable of being operational at any one point in time with regard to acting as the HMI for the supervisory and control functions for the entire MSHL.

D. Unless otherwise stated, all functionality defined for the OCC subsystem shall be available at the OCC, EBCC and MCC.

E. The maximum real-time display delay between when a status change has occurred at a monitored entity or an event has taken place and that change is displayed on OCC workstations shall not exceed three (3) seconds.

F. A dedicated master time clock shall be provided as part of the OCC subsystem. The master time clock will be used by the OCC subsystem and all other equipment utilizing date/time shall be synchronized to the OCC’s master time clock. This includes, but is not limited to: OCC equipment, EBCC equipment, MCC equipment, onboard CBTC equipment, Local Traffic Controller (LTC) equipment, interlocking equipment and wayside CBTC equipment.

G. The OCC master time clock shall be used for the time stamping of all logged data and events throughout the MSHL System.

H. OCC Equipment Requirements
1. All OCC subsystem and related equipment necessary to install and operate the CBTC System shall be supplied.

2. The following fully functional workstations shall be provided:

   a. OCC (refer to the Contract Drawing number “PTC-CC-2”):
      1) Position 1 (white circled “1”) – Dispatcher position. One workstation shall be provided. A Keyboard-Video-Mouse switch shall be provided to permit the MSHL workstation and an existing workstation (Norristown High Speed Line) to share the MSHL keyboard, mouse and video monitors.
      2) Position 2 (white circled “2”) – Dispatcher position. One workstation shall be provided.
      3) Position 3 (white circled “3”) – Video wall. Two workstations shall be provided with a single monitor each. These workstations shall be used to drive the existing 6-panel video wall adjacent to positions 1 and 2. The existing video wall is and will be used to provide a MSHL line overview display across the 6-panel display. One workstation designated the primary and the other the backup; switching between the active and backup workstations shall be manually accomplished. Each workstation shall have eight (8) video outputs which shall be connected as follows:
         • 1 output: connected to the provided monitor for local administration of the workstation
         • 6 outputs: connected to the existing video wall equipment to provide the line overview
         • 1 output: spare to be used for either another local monitor or the video wall

      The Contractor shall work with SEPTA’s video wall Contractor (Vistacom) to interface the workstations to the existing video wall equipment.
      4) Position 4 (white circled “4”) – Chief Dispatcher position. One workstation shall be provided. A Keyboard-Video-Mouse switch shall be provided to permit the MSHL workstation and the following existing workstations to share the MSHL keyboard, mouse and video monitors:
         • Norristown High Speed Line workstation
         • Market Frankford Line workstation
         • Broad Street Line workstation
         • Spare workstation
      5) Position 5 (white circled “5”) – Telcom room. One workstation shall be provided with a single monitor. The workstations shall be used to drive three (3) existing remotely located monitors with a MSHL line overview display across the three (3) existing monitors.
Each workstation shall have four (4) video outputs which shall be connected as follows:

- 1 output: connected to the provided monitor for local administration of the workstation
- 3 outputs: connected to the three (3) existing monitors to provide the remote line overview
- 1 output: spare to be used for either another local monitor or a remote monitor

The Contractor shall work with SEPTA’s video wall Contractor (Vistacom) to interface the workstation to the three (3) existing monitors.

6) Position 6 (white circled “6”) – Maintenance position. One workstation shall be provided.

7) One color laser printer shall be provided.

Three (3) workstations shall be installed for use by the OCC Dispatchers:
1) Two (2) workstations shall be installed for use by the OCC Chief Dispatchers
2) One (1) workstation for use by maintenance personnel at the OCC
3) One color laser printer

b. EBCC (refer to the Contract Drawing number “PTC-CC-7”):
   1) Two (2) workstations shall be installed for use by the OCC Dispatchers

   2) One color laser printer shall be provided.

3. All workstations shall be provided with MSHL playback capability.

4. All OCC workstations shall be identical unless otherwise noted. Workstations shall consist of an industrial-grade current-generation (hardware and software) Personal Computer (PC) with two-three (2-3) 21-22 inches or larger LCD-LED monitors, a keyboard and a mouse except as noted.

5. Identical Two (2), self-redundant servers (the server is itself redundant) shall be provided and installed as follows:
   - the OCC Server Room (20th Floor, 1234 Market Street, refer to the Contract Drawing number “PTC-CC-4” for layout), Rack positions 12, 13, 14 may be used by the MSHL Contractor for the OCC servers and equipment.
   - and the EBCC (Market Street East Platform Complex), refer to the Contract Drawing number “PTC-CC-7” for layout). Adequate space will be made available in the server room for the EBCC servers and equipment.

5-6. The self-redundant servers used by the OCC and EBCC shall be a rack-mount design. Within each of the self-redundant servers, automatic fail-over to the standby (non-failed) server in the event the in-control server experiences a failure shall be provided. This fail-over process shall be automatic and
transparent to the operation of the CBTC System except for the resulting equipment status alarm indications.

6.7. Switching between the OCC and EBCC servers shall be manually performed. It shall be possible to perform all actions necessary to switch between the OCC and EBCC servers regardless of the operational state of the currently in-control server. Switching between the OCC and EBCC servers shall cause no disruption to the on-going CBTC operations;

7.8. Data synchronization shall be continuously maintained between the OCC and EBCC servers.

8.9. Failures of components of the self-redundant servers, including the complete failure of a single server computer within the self-redundant server, shall be self-detecting and annunciated as an alarm at the OCC workstations.

9. Refer to the Contract Drawings for the space envelope available for the OCC and EBCC workstations.

10. Each redundant server shall include a dedicated workstation, video display, etc., to perform administration and maintenance on the server.

11. Two (2) laptop computers with the necessary software shall be provided for OCC equipment diagnostic and maintenance purposes.

12. The OCC subsystem shall interface to the Network Management System (NMS) to provide a single-point interface between the OCC Dispatcher and the state of the CBTC System including the NMS. Sufficient information shall be made available to the OCC displays to inform the OCC Dispatcher if there are events in progress which require attention, possibly including investigating status provided by a NMS workstation.

I. HMI Requirements

1. All OCC subsystem display screens, including all Graphical User Interface (GUIs) and HMI operational procedures, screens and methods of operating the CBTC System, shall be presented to SEPTA for review and approval during the project. Prototype Graphical User Interface (GUI) screens and related HMI interactions shall modeled or mocked-up in realistic fashion to enable SEPTA to review the proposed GUI display screens and HMI functions and Dispatcher interactions in a realistic manner.

2. The HMI of the OCC subsystem shall use modern technology. Touch screens shall not be used. The majority of user inputs shall be via a mouse with occasional keyboard input as approved by the SEPTA Project Manager.

3. The OCC workstations located at 1234 Markey Str. shall drive the existing “video wall” dedicated to the MSHL which is located at 1234 Market Str.

4. All OCC workstations shall be identically capable of displaying the same information, processing user actions, and performing the same functions.

5. Only users logged in as “Dispatcher” or a higher level of privilege shall be capable of performing control actions or executing commands which affect CBTC operations or control infrastructure, except as noted.
6-5. All Dispatcher actions shall result in some form of immediate feedback.

7-6. All commands shall be clearly annunciated with an affirmative (success) or negative (failure) response by the OCC subsystem. Negative annunciation shall include an error message with a description of the reason for the failure.

8-7. Commands or menu selections which cannot be performed or executed, based on the current system state shall be “grayed-out” or otherwise clearly indicated as not available for selection. All operations shall be carried out in as few steps as possible and it shall be possible to stop the operation at any time before selecting the final action which causes the operation to be issued as a command or set of commands. During dialogues, data entry operations, etc., the user shall be led step-by-step so as to minimize the need to remember the individual operational procedures, sequences, and to minimize the need for prior knowledge.

9-8. The GUI shall support display attributes like color, color intensity, flashing, texture, and appended symbols to highlight dynamic data fields, such as alarms, device and measurement status, data quality, data entry locations, and error conditions. These highlighting techniques shall be uniformly implemented across all OCC functions.

10-9. The OCC subsystem shall support the following roles:
   a. Supervisor
   b. Dispatcher
   c. Maintainer
   d. View only

11-10. Each user of a OCC workstation shall be assigned unique login credentials and a single role as identified above. Only the Supervisor shall have the ability to modify/add/delete users and delete or otherwise modify operating data records. The specifics of the permissions for each role, including the addition or deletion of roles beyond that identified herein, shall be determined during project execution.

12-11. The following sections define the display screen requirements. Other display screens shall be suggested by the Contractor based on their experience with similar transit systems and specifics of their CBTC System design and capabilities. However, in general the OCC workstations shall work similar to the workstations presently used by the MSHL Dispatchers.
   a. System Overview Display Screen
      1) There shall be a System Overview Display Screen (SODS) which shall provide an approximately scaled overview of the entire line including Route and Block numbers, all track sections, trolleys including their current position or area of occupancy and unique identification number, roadway crossings, trolley bar signal displayed aspect, platforms, control section boundaries, track switch positions and locked status, signal displayed status, track and switch block status, traffic direction, switch heater status,
intrusion and fire alarm status and other relevant items necessary or helpful to the OCC personnel in the day to day management of the MSHL operations.

2) The SODS shall display shall indicate track which is unpowered by coloring that track yellow or another method approved by the SEPTA Project Manager.

3) Points which do not have position detectors shall be displayed differently from points with position detectors and shall not be shown in one aligned position or another.

4) The following colors and attributes of on-screen items shall be generally used:
   a) Colors green – Normal or satisfactory state.
   b) Color red – Abnormal or unsatisfactory state.
   c) Color amber – Override state.
   d) Blue – Blocked status.
   e) Flashing – Something in transit or requiring the Dispatcher’s attention.

5) Features shall include the following:
   a) Panning. This shall be accomplished by dragging the mouse across the screen rather than by “slider bars” along the edges of the display screen.
   b) Zooming. This shall be accomplished by use of the mouse roller wheel or other approved method.
   c) “Drilling down” to gain more information on an object.
   d) Splitting the display of the line overview across all monitors associated with one workstation. This shall also be possible using the entire video wall currently installed on the 19th Floor at 1234 Market Street.
   e) Using one monitor for the display of the entire line overview.

6) The location of all trolleys on the Line shall be indicated with the positional accuracy sent by the trolley to the wayside. Trolley travel direction, unique trolley identification, assigned Route and Block, and whether the trolley is a one-car or two-car consist shall also be indicated on each screen.

7) Track section occupancy shall be indicated for occupied track sections within the interlockings or other locations as determined during final design.

8) Motorized switches shall clearly indicate their point position, whether they are electrically locked, and whether the switches are operating according to automatic route setting or not. Switches which do not have point position detectors are excepted from this requirement.
9) Selecting a trolley shall result in further information for the selected trolley being displayed such as: position, speed, cab activation status, activated alarms, operating mode, current and next service patterns, and other relevant statuses.

10) Trolleys shall be displayed with a unique color if their operating mode is not the normal operating mode for the area of track they are located.

11) The OCC Dispatcher shall be able to select one or more trolleys and send a textual message to the trolley(s) for display on the selected trolley(s) Operator Display Unit (ODU).

12) Track sections and equipment shall be depicted differently based on the status of blocking in effect for each section.

13) Track switch heaters shall be controlled from the SODS, refer to Section 13584.

b. Event Display Screen

1) There shall be an Event Display Screen (EDS) which shall provide the status of various subsystem-related events, alarms, and general statuses.

2) The EDS shall be used as a single-point for alarm recording for all supplied subsystems and equipment which are part of the MSHL System.

3) Three (3) categories of events shall be provided as follows:
   a) Category 1 – Category 1 events are events which require immediate attention due to the potential of the event to negatively affect personnel safety and/or safe operation of the MSHL System. Category 1 event activation shall be accompanied by a visual indication and an unique audible sound (configurable in on/off) and shall require acknowledgement (configurable as required/not required).
   b) Category 2 - Category 2 events are events which represent an immediate potential to disrupt the normal operation of the MSHL System. Category 2 event activation shall be accompanied by a visual indication and an unique audible sound (configurable in on/off) and shall require acknowledgement (configurable as required/not required).
   c) Category 3 - Category 3 events are events related to equipment operating status and information reporting events and generally can be considered as status reporting events.

4) All Events shall be time/date-stamped and recorded upon receipt by the OCC equipment.

5) The unique event activation source shall be provided in the event data.
6) If an event’s activation source is a trolley, the trolley’s unique identifying number, position and operating mode shall be recorded with the event.

7) If a particular event consists only of an event activation and does not have a corresponding restoration event, the event activation status ceasing to exist shall be considered as a restoration event.

8) The exact list of all events and alarms, their respective categorization, the actions required to be taken and the party responsible to take any action shall be determined during the course of the project and their final disposition shall be as reviewed and approved by SEPTA.

9) For events requiring acknowledgement, the specific event acknowledged, the person performing the acknowledgement and the date and time shall be recorded. At any time, the OCC shall be able to send the currently displayed event list to the printer or to a comma-separated ASCII text file.

10) The Contractor shall provide the ability to store, categorize, trend, sort, display, etc., all event and alarms and present them in various pre-defined reports which are automatically created by the OCC subsystem with minimum operator actions. The reports to be generated by this function shall be subject to the SEPTA Project Manager’s review and approval.

11) All event and alarm data shall be capable of being output by the OCC subsystem in a comma-separated-value file format.

12) A user must be logged in as a Supervisor to be able to change any of the EDS configuration settings.

c. OCC Maintenance Display Screen

1) An OCC Maintenance Display Screen (MDS) shall be provided and shall contain functions as necessary for the general support of the OCC subsystem such as adding/deleting/modifying OCC users, backup and file maintenance activities, time and day setting, and other required maintenance operations. A user must be logged in as Supervisor to access the MDS.

d. Other Maintenance Screens

1) The display screens available at the Maintenance workstations including data viewing, report generation, etc., shall be available at the OCC workstations.

d-e. Form Recording Screens

1) The following paragraphs describe several data recording screens, or “templates”, in which a data entry form is filled in by an OCC Dispatcher with context help provided by the OCC subsystem. These screens shall consist of a template to be filled in by OCC personnel, the contents of which shall be defined during Project
execution. All saved forms shall be searchable by date, specific form type used, and person responsible for entering the data. Upon completion and acceptance of the entered data, the form is to be saved for recall and printing at a later date. A user must be logged in as Supervisor to modify previously saved forms.

2) Templates typically will have automation which occurs as a result of the specific template being filled in and “issued”. For example, the TSR template will create a TSR on the track sections identified in the template.

3) A data recording screen shall have a means by which to revert the automation carried out as a result of the template originally being issued, if applicable (e.g., canceling a TSR).

4) Templates shall include:
   a) Bulletin Order Recording Template
      i) A Bulletin Order Recording Template shall be provided which enables an OCC Dispatcher to enter data specific to the Bulletin Order being verbally issued to trolley drivers, track workers, and other operations personnel.
   b) Track Removed From Service Template
      i) A Track Removed From Service Template shall be provided which enables an OCC Dispatcher to remove specified sections of track from service. Tracks removed from service shall be vitally protected from trolley encroachment.
   c) Track Blocking Template
      i) A Track Blocking Template shall be provided which enables an OCC Dispatcher to perform track blocking on specified sections of track and other track objects.
   d) TSR Template
      i) A TSR Template shall be provided which enables an OCC Dispatcher to set a reduced speed on defined sections of track.
   e) Other Templates
      i) Other templates shall be required based on the general categories of items for which a NORAC Form-D is typically used and based on a Contractor’s particular design.

J. Trolley Routing

1. Route and Block and Service Pattern Operations
a. Trolley travel assignments shall be keyed off data generated by a SEPTA-owned Route and Block Scheduling Program (RBSP). The RBSP will be used by SEPTA to generate the information necessary to be input by the OCC equipment to enable trolley travel assignments and related configurable functionality to be accomplished by the OCC. The RBSP-generated data is in a Comma-Separated-Values format.

b. The RBSP will define a series of end-to-end paths (i.e., the “Route and Block”) for each trolley. The Route and Blocks shall be linked so as to construct round-trips, or service patterns, for each trolley (e.g., from 69th Street Terminal to Media EOL and back). The OCC shall automatically assign the defined succeeding Route and Blocks to each trolley as required, without requiring Dispatcher input, so as to keep the trolleys moving along without delay.

c. The OCC shall enable the Dispatcher to view the RBSP information associated with each trolley and to change the Route and Block/service pattern for any trolley at any time.

d. The OCC shall vet the RBSP-provided data prior to its assignment to a trolley to ensure the Route and Block/service pattern can be accomplished.

e. If a Route and Block/service pattern’s ability to be accomplished by a consist depends on the length of the consist, the OCC shall not let a Route and Block/service pattern be assigned to a consist who’s length is incompatible with the Route and Block/service pattern.

f. Schedule operation functions shall be enabled/disabled from the Dispatchers workstation.

g. Standard routes shall be defined for every path between any two control points. Both normal and reverse travel direction operations shall be included.

h. Turnback routes shall be available for every siding, crossover and turnout under signal control. Both normal and reverse travel direction operations shall be included.

i. End of Line (EOL) turnback moves shall be supported to allow a trolley to reverse direction and make its return trip automatically and by schedule.

j. Entrance routes from yard tracks to main line tracks shall be supported to allow a trolley to move from the yard tracks onto revenue service tracks.

k. Exit routes from main line tracks to yard tracks shall be supported to allow a trolley to move from the main line tracks to yard tracks.

l. The same service pattern identifier (Route and Block) shall be displayed to the trolley operator and at the OCC for that trolley.

m. Predefined Route and Blocks shall be developed to support a wide range of service operations.
n. Prior to entering revenue tracks, the onboard CBTC equipment will automatically request a Route and Block assignment from the OCC when the trolley arrives at a pre-defined staging location prior to entering Main Line tracks. The OCC shall automatically respond by providing the pre-assigned Route and Block to the requesting trolley.

2. Automatic Route Setting
   a. An Automatic Route Setting (ARS) function shall be provided. ARS is the process by which the OCC automatically executes command requests to the Interlocking and wayside CBTC equipment as needed to set traffic direction, align switches, clear interlocking signals, etc., to align a route or a sequence of routes to enable a trolley to follow its assigned Route and Block without interaction from the OCC personnel and with no delay to impede the trolley movement.

   b. Once a trolley is assigned a service pattern, the OCC shall automatically monitor the position of the trolley and automatically interact as needed with the interlockings, wayside CBTC, and other equipment as necessary to enable the trolley to continue along its assigned service pattern without delay.

   c. The OCC subsystem shall monitor the progress of a trolley along its assigned service pattern and generate and alarm if the trolley deviates from its assigned service pattern or remains stationary for a configurable amount of time.

   d. The ARS function shall regulate the merging of the trolleys at common junctions to ensure trolleys operate according to junction priority requirements specified elsewhere.

   e. The ARS function shall be able to be disabled and enabled on an individual interlocking basis. If an interlocking has had its ARS function disabled, that fact shall be clearly indicated on the SODS.

   f. It shall be possible to set automatic routes around track sections and track object which have blocking applied.

K. Manual Control Functions

1. The following OCC commands shall be provided:
   a. Manual routes shall be setup by the OCC Dispatcher using standard Enter / Exit operation.

   b. Temporary Speed Restrictions (TSRs) – The OCC Dispatcher shall be able to set and cancel TSRs for all track sections. The sectionalization of the track for the purpose of assigning TSRs shall be determined during Project execution. The TSR function shall be vitally designed and implemented. If the OCC attempts to set a TSR of zero speed at a track location that is likely to cause a trolley to be stopped while blocking a roadway crossing, or if the TSR is being applied to track which contains...
an operating trolley, the OCC Dispatcher shall be clearly warned of this fact.

c. Track blocking – The OCC Dispatcher shall be able to block portions of track with a granularity based on the sectionalization defined for TSRs (see above).

d-e. Device blocking – The OCC Dispatcher shall be able to block various track object (switches, signals, etc.).

d-e. Other commands – Other commands as necessary for the efficient operation of the MSHL based on a particular Contractor’s design.

L. OCC Data Recording, Playback and Simulation

1. OCC Data Recording
   a. The Data Recording function shall continuously record the state of all objects monitored by the OCC and all OCC Dispatcher actions. The intent of recording this data is to allow playback for training and event reconstruction.

   b. The OCC workstations, not currently used to monitor or control the MSHL, shall be useable for off-line OCC tasks such as playing back of recorded information, OCC alarm review, report generation, operation of the RBSP and related tasks.

   c. All data recorded by the OCC shall be time and date stamped.

   d. The OCC shall record all actions including the result of any commands issued, command result and the identity of the logged in user and workstation used.

   e. The OCC servers shall be capable of unattended recording of at least one year of full operational data. The operational data shall be stored within the OCC servers on a separate physical disk drive subsystem used exclusively to store the recorded operational data. The operational data stored on the OCC servers shall be continuously synced so that the same data is available at either server at all times. Each OCC server shall have a means to save the recorded operational data to a permanent storage medium (e.g., DVD disk). An event, managed from the EDS, shall be provided to remind OCC personnel to perform a transfer of the recorded operational data to the permanent storage medium on a configurable periodic basis. An event, managed from the EDS, shall be provided to inform OCC personnel that the storage space on the OCC servers is at a configurable amount of the total available.

2. OCC Data Playback
   a. The playback function shall be used to playback the recorded OCC data on any workstation at the OCC. The display screens shall include all those found on the OCC workstations. In addition, other display screens shall be provided to facilitate the functions of playback.
b. The user shall be able to select a starting point in a playback file. For example, it shall be possible to start the playback of a file from the middle of the file rather than require the file to be played starting at the beginning to get to the desired point.

c. It shall be possible to speed up and slow down the playback of a file.

d. The display screens which show the played-back data and shall indicate the state of the displays screens exactly as they appeared during the actual system operation.

3. OCC Simulation and Training
   a. The OCC equipment shall provide a simulation of the MSHL operations such that all control and operational functions supported by the OCC can be exercised and used for Dispatcher training purposes.
   b. Failure scenarios shall be supported to permit training of Dispatchers to deal with failure operations. Failure operations to be simulated shall include but not be limited to:
      1) A trolley which has failed to communicate with the wayside equipment and must be manually driven off the system.
      2) Failure of an interlocking to move switch points.
      3) Failure of an interlocking to clear signal status.
      4) Failed trolley which cannot be moved requiring other trolleys to be rerouted around it.
      5) Sending trolleys into and out of all siding tracks.
      6) A LTC which fails to grant a proceed trolley bar signal aspect to an approaching trolley.
      7) Complete failure of a redundant zone controller (i.e.: trolleys must be manually routed though the failed zone).
      8) Additional failure scenarios based on a particular Contractor’s design.
   c. Non-SEPTA owned equipment which is required to operate the MSHL CBTC System (e.g., certain traffic controllers) shall also be simulated.
   d. A Dispatcher training plan shall be provided which will be used to train Dispatchers on the operation of the MSHL.

1.03 MAINTENANCE CONTROL CENTER REQUIREMENTS

   A. The MCC’s workstations shall provide all the functionality found on the OCC workstations as noted herein. In addition, The MCC workstations shall collect, store and support data analysis of trolley, wayside communications and OCC data including events and alarms, NMS data, and any other information required to diagnosis troubleshoot, trend, record, store and report on the operation of the MSHL.

   B. The MCC workstations shall connect to and operate with the in-control OCC server just as is done by the OCC workstations.
C. **MCC Workstation Locations:**

1. A single workstation shall be provided at the following maintenance locations:
   - Fern Rock Maintenance Headquarters, and
   - Victory Avenue Maintenance Facility

D. **MCC workstations shall be capable of operation as either maintenance workstations or as OCC dispatcher workstations as follows:**

1. **Control Mode** – In this mode of operation, the designated MCC workstation shall be the sole Dispatcher control location for the operation of the entire MSHL system. The designated MCC workstation will operate just as if it were a workstation located in the OCC or EBCC (whichever is in control). During operation in Control Mode, non-necessary MCC workstation operations (e.g., maintenance operations) shall be suspended. When a MCC workstation is in Control Mode, the function of the workstations of the OCC and EBCC shall be suspended (i.e.: the OCC/EBCC workstations shall not be capable of exerting control operations over the MSHL when a MCC workstation is in Control Mode).

2. **Non-Control Mode** – In this mode of operation, the MCC workstation shall be capable of all MCC and OCC workstation operations except those which can affect control of the MSHL system. In this mode, a MCC workstation will be used for maintenance and troubleshooting tasks rather than MSHL line control tasks.

E. **Unless a workstation of the MCC subsystem is in “Control Mode”, there is nothing the MCC subsystem can do, intentionally or not, to interfere with or otherwise affect the operation of the OCC subsystem nor any part of the operating MSHL.**

F. **There shall be nothing the MCC subsystem is capable of which can in any way degrade the performance of the OCC subsystem or affect the control or performance of any other subsystem, nor cause an unsafe condition, nor lead to an unsafe condition on the MSHL.**

G. **The functions available at the MCC workstations shall be identical.**

H. **The MCC subsystem roles and responsibilities shall be the same as for the OCC subsystem.**

I. **Two (2) laptop computers with the necessary software shall be provided for MCC equipment diagnostic and maintenance purposes. Data Recording and Playback functions shall be the same as provided for the OCC and it shall be possible for the MCC and OCC (or OCC) workstations to playback the same incidents and at the same time.**
A Configurable Item Display Screen (CMP) shall be provided at the MCC workstations which shall display the version of all field-upgradable configurable items such as software items, data or database items, configuration or “personality” files, and other such items installed on all equipment supplied as part of the MSHL CBTC System including that installed on trolleys. The CMP shall enable the printing dated reports which identify the revisions of configurable items installed and the associated hardware item.

Requirements for the MCC’s recording of the data logged by the onboard CBTC equipment are as follows:

(Note: This section does not refer to the onboard crash hardened event recorder.)

a. Each trolley shall provide the MCC subsystem its stored data logs (defined elsewhere in these Specifications) no less frequently than every twenty four (24) hours regardless of the trolley’s location.

b. The MCC subsystem shall maintain a record of the logs for each trolley in a comma separated values format.

c. The MCC subsystem shall generate the following reports after the end of each revenue service day:

1) Onboard equipment failure report – this report shall list the recorded onboard equipment failures for each trolley.

2) Wayside equipment failure report – this report shall list the recorded equipment failures for the entire MSHL System which are not installed onboard trolleys.

3) Protective action report – this report shall list the recorded automatic protective actions taken by the CBTC equipment.

4) Anomalous event report – Anomalous events shall include: loss of communications with the wayside, failure to read a transponder tag, trolley driver selection of Bypass Mode, control transfer to a standby device, and other occurrences based on a particular Contractor’s design.

5) Trolley mileage report – This report shall list each trolley and the total miles traveled since its in-service date and the total miles traveled since a reset was performed to the trolleys mileage recording function.

d. These reports shall be further defined, and additional required reports identified during the execution of the Project in collaboration with SEPTA and subject to the review and approval of SEPTA.

MSHL Subsystem Communications Recording

a. For the purposes of this specification, a reference architecture diagram is provided in the Figure below. The bolded lines represent interfaces which shall have their data recorded by the MCC subsystem. It is recognized that there likely will be other interfaces implemented,
networked or otherwise, which are not shown in this reference diagram. To the extent these additional interfaces perform a control function for the MSHL System (e.g., Programmable Logic Controllers which interface to the LTCs), the data on such interfaces is to be recorded by the MCC subsystem.

![Diagram of CBTC Data Interfaces]

**Figure 1: Typical CBTC Data Interfaces**

b. All network data messages sent between the various network-connected elements of the MSHL System, and other interfaces involved in the performance a control function for the MSHL System, shall be recorded by the MCC subsystem as defined in this section.

c. Network traffic between the elements of the OCC subsystem (e.g., between the OCC and EBCC servers) need not be recorded; however, traffic between the OCC subsystem and other subsystem shall be recorded.
d. A playback function shall be provided which uses the data recorded per this section to provide a playback function similar to that provided for the OCC subsystem except this playback function shall use the actual networking messages between subsystems to reconstruct the operation of the MSHL.

e. The playback function shall provide a system overview display, similar to the OCC SODS except additional details shall be provided for such items as bit fields within messages, internal statuses as reported through the messages recorded, requests and acknowledgements between subsystem equipment. In addition, the timing sequence of the various messages and sequence of control requests and actions shall be provided in an understandable format so these sequences can be understood without reading the actual network messages themselves.

f. A convenient method for transferring the recorded data to a USB memory device shall be provided to enable this data to be moved from the MCC workstations to other computers.

2. OCC Alarm and Event Data

a. Alarm and event data from the OCC subsystem shall be available at the MCC workstations in read-only form with minimal time delay between when the data is available at the OCC workstations and when it is available at the MCC workstations.

b. The same alarm operations (e.g., report generation, sorting) and user interface provided by the OCC subsystem for event data shall be available at the MCC workstations except as noted.

c. The MCC workstations shall not be capable of modifying, or otherwise changing any recorded data unless the MCC workstation is operating in Control Mode.

1.04 Other Requirements

L-A. An OCC workstation shall be provided and installed on the 13th Floor of 1234 Market Str. (SEPTA Communications and Signals floor).

PART 2 – PRODUCTS

This Part not used in this Section.

PART 3 – EXECUTION

This Part not used in this Section.

END OF SECTION 13594