Phase 2: Extension To Dulles Airport/Route 772

STATEMENT OF WORK

Design-Build Package B

Rail Yard and Maintenance Facility

February 10, 2014

(Rev. 0 – Issued with RFP)

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REVISION HISTORY

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SECTION 1. GENERAL

1.1 PROJECT OVERVIEW

The Airports Authority, in cooperation with the Washington Metropolitan Area Transit Authority ("WMATA"), the Commonwealth of Virginia, Fairfax County and Loudoun County, is designing and constructing the Project, which is a 23.1-mile extension of WMATA's Metrorail system in Northern Virginia's Dulles Corridor. This new line has been designated as the "Silver Line" by WMATA (see Figure 1).

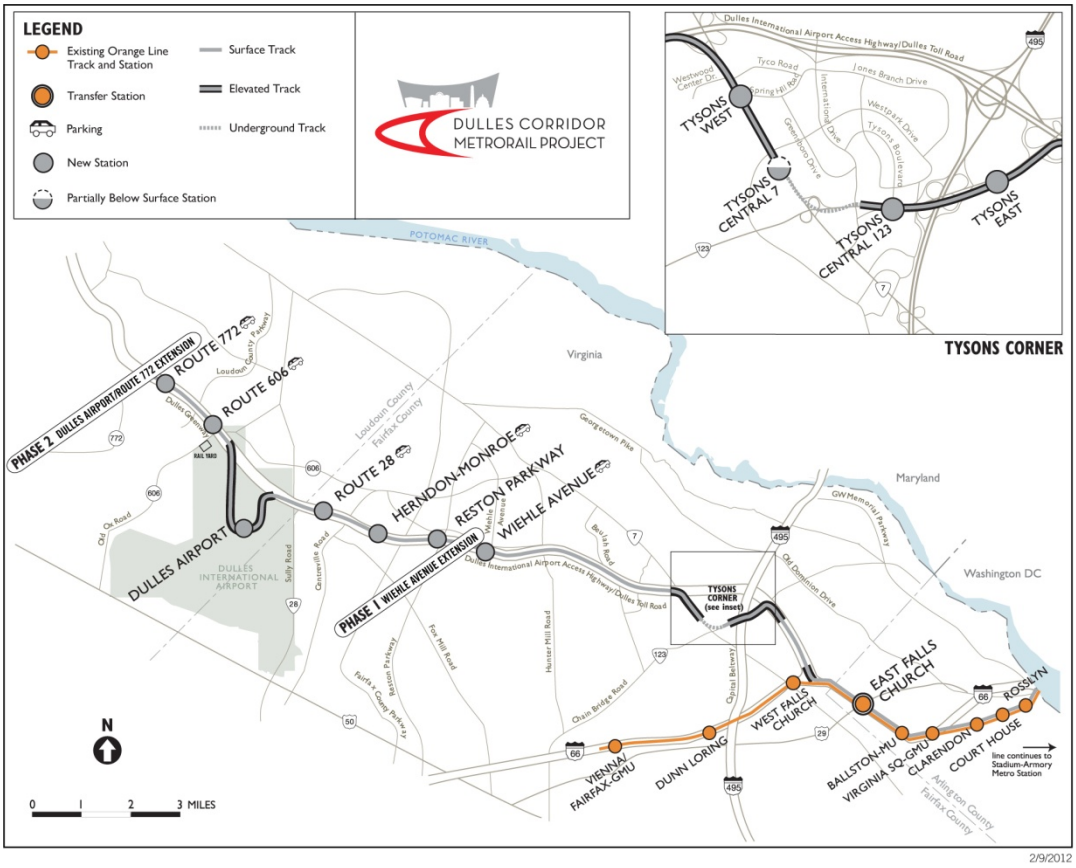


Figure 1-1. Dulles Corridor Metrorail Project Location

Construction of Phase 1 – the first 11.7 miles of new track and five new Metrorail stations (four in Tysons Corner and an interim terminus at Wiehle Avenue in Reston) – is currently nearing completion and will begin operations in early 2014. Phase 2 will extend the Silver Line 11.4 miles northwest, through Washington Dulles International Airport ("Dulles Airport") to a terminus near Route 772 in eastern Loudoun County. Phase 2 includes six additional stations, a new rail maintenance and storage facility at Dulles Airport and five new parking garages with a total of 8,900 parking spaces for Silver Line users. Wayside facilities, including traction power substations, tie-breaker stations, and stormwater management ponds, will also be constructed along the alignment.

As shown in Figure 2, the Maintenance Facility site is located on Dulles Airport property in the northwest quadrant of the Airport, bounded by Horsepen Run and Route 606 (West Ox Road). The site is located within the boundaries of Dulles Airport and access to the site will be subject to the Airports Authority's access controls.

Figure 1-2. Dulles Metrorail Project Maintenance Facility Site

1.2 PACKAGE B SCOPE

The Contractor shall perform all design, construction, and other services in accordance with the Contract. Package B's scope of work includes, but is not limited to, the following elements:

- **Rail Tracks and Supporting Infrastructure**
  - At-grade rail tracks and supporting infrastructure necessary to provide access to the facilities and for railcar storage, railcar maintenance, and non-revenue railcar access to maintenance facilities.
- **Railcar Service and Inspection (S&I) Facilities**
  - Facilities for the servicing, inspection and repair of railcars, including integrated equipment such as car lifts, wheel-truing machine and cranes. These facilities shall include support areas such as bench-work areas, meeting rooms, offices, and employee comfort areas.
  - A yard control tower.
  - Building utilities, including a DC power stinger system in the railcar shop area.
  - Portable maintenance equipment and office furnishings will be provided by WMATA.

- **Transportation and Police Facilities**
  - Facilities for train dispatch, operation, and supervisory personnel. These facilities shall include support areas such as meeting rooms, offices, and employee comfort areas.
  - Facilities for police and security personnel.
  - Portable equipment and office furnishings will be provided by WMATA.

- **Maintenance of Way Facilities**
  - Facilities for the storage of maintenance-of-way (MOW) materials and equipment.
  - Portable equipment and office furnishings will be provided by WMATA.

- **Materials Warehouse Facilities**
  - Facilities for the storage and handling of material for maintenance and renewal of railcars and other WMATA equipment and facilities.
  - Material storage and handling equipment and office furnishings will be provided by WMATA.

- **Systems**
  - Communications, traction power substations, and train control facilities and equipment needed for Package B and connections to WMATA operational control facilities.

- **Roadway Construction and Improvements**
  - Site and roadway improvements necessary for construction and operation of the Package B facilities.

- **Drainage and Stormwater Management (SWM)**
  - SWM facilities, including maintenance vehicle access and parking, as well as expansion of existing SWM ponds to provide sufficient drainage for all of the Package B facilities.

- **Utilities**
  - New utilities as needed to construct the Package B facilities and to provide connections to the Package B facilities. The types of utilities affected include water, storm sewer, sanitary sewer, gas, electric, and communications lines.
  - Relocation of existing utilities as necessary for construction of the Package B facilities.
  - Ductbank and cabling for 34.5 kV power from the Package A interface point

Package B may also include two optional scope items that are shown in the Contract Drawings: 1) the design and construction of an expansion to the Warehouse Building and 2) the addition of railcar hoists on Track S-5 in the S&I Building.

1.3 GENERAL REQUIREMENTS

This Statement of Work generally defines the scope, configuration, and performance requirements necessary to ensure that the delivery of Package B meets the requirements of the Airports Authority and other Project Partners and is fully integrated with the Package A portion of the Project. The full scope and specific requirements for Package B are provided in the Project Technical Requirements documents, which include this Statement of Work, the Technical Specifications, the Contract Drawings, and Safety and Quality requirements.

1.4 RESPONSIBILITY OF THE CONTRACTOR

The Contractor is responsible for the successful and timely delivery of Package B, including the design, construction, supply, installation, testing and acceptance of all elements, facilities and equipment to the Airports Authority, WMATA, and the Virginia Department of Transportation (VDOT) upon completion.

- The Contractor is responsible for providing a complete solution for Package B that addresses all design, functional, and operational issues. The Contractor is responsible for coordinating the requirements and activities among the various disciplines and entities necessary to design and construct a fully integrated Package B.
- The Contractor shall use the Project Technical Requirements as the basis for developing its designs and shall be responsible for ensuring compliance with applicable codes, standards, and other conditions required by regulatory or approving entities, accepted industry and professional design practices, and other applicable requirements. The Contractor shall confirm final dimensions and precise locations of all Package B elements, facilities, and equipment based on applicable criteria, functional relationships, Codes and Standards, Laws, Regulations and Ordinances, site-specific requirements (including vertical and horizontal clearances), and operating and maintenance requirements.
- The Contractor shall be responsible for confirming the accuracy and completeness of all data utilized in the design and construction of Package B.
- The Contractor shall be responsible for coordination of all interfaces with existing WMATA facilities and systems, Airports Authority facilities and systems, VDOT facilities and systems, utilities, and other Phase 2 elements, including Package A (Rail Line, Stations and Systems).
- The Contractor shall be responsible for preparing all necessary design, permitting, construction, and acceptance documents in accordance with the Contract and the requirements defined in Project Technical Requirements.
- The Contractor shall obtain approval from the Airports Authority for any changes to, or deviations from, the Project Technical Requirements and applicable criteria, codes and standards.
- The Contractor shall be responsible for obtaining all approvals of design, construction, and testing activities in accordance with the Contract and the requirements defined in the Project Technical Requirements.

- The Contractor shall obtain, or assist in obtaining, on behalf of the Airports Authority where applicable, all permits necessary for the temporary and permanent construction of Package B.
- The Contractor shall be responsible for identifying and obtaining all necessary approvals to occupy all areas for materials storage, laydown, equipment, temporary facilities and other similar aspects of the work.
- The Contractor shall be responsible for mitigation of all hazardous environmental conditions encountered during the design and construction of Package B. Information on existing environmental conditions has been provided to the Contractor by the Airports Authority.
- The Contractor shall be responsible for developing and obtaining approval of necessary Maintenance of Traffic plans.
- The Contractor shall be responsible for maintenance and improvements to existing roadways and pavement as necessary to accommodate construction traffic and associated loading. The Contractor shall repair roads and pavement damaged during construction and hauling operations.
- The Contractor shall complete and document the successful performance of all inspections, testing, and functional demonstrations necessary to verify compliance with Package B requirements to the satisfaction of the Airports Authority, WMATA, VDOT, and other approving entities.
- The Contractor shall be responsible for conducting and/or supporting public and outreach activities in accordance with the Contract requirements.
- The Contractor shall prepare and deliver as-built and record documents in accordance with the Contract requirements.

1.5 DOCUMENTS AVAILABLE TO CONTRACTOR

1.5.1 PROJECT TECHNICAL REQUIREMENTS

The following documents provided to the Contractor constitute the Project Technical Requirements and are listed in order of precedence. The scope for Package B specified in the Project Technical Requirements is mandatory, with the understanding that specific sections of this Statement of Work may modify these requirements by providing for additional flexibility, requirements, and/or restrictions. The Airports Authority recognizes that the Contractor may, during the design development process, offer design and/or construction solutions that contain minor variations in the location(s), profile(s), and/or configuration(s) of the Package B elements, facilities, and equipment shown in the Project Technical Requirements. All such variations are subject to approval by the Airports Authority and WMATA and shall comply with applicable criteria, codes, standards, accepted industry design or construction practices, and other applicable requirements.

1. Package B Statement of Work and Appendices (February 2014)

2. Technical Specifications

Initial versions of the Technical Specifications are included the Project Technical Requirements. The most current revision of each specification shall be used by the Contractor as the basis for preparing final specifications needed to complete design and construction of Package B. When preparing the final specifications, the Contractor is responsible for reorganizing and reformatting all specifications to comply with the 50-division CSI format, and obtaining necessary approvals in accordance with the Contract requirements. A conversion matrix showing the reformatting approach used by the Package A Contractor is provided in **Appendix 1** (Technical Specification Conversion Template). The Contractor shall follow this matrix when preparing the Package B Technical Specifications.

- Technical Specifications, Volume 1 – Division 02 (January 2014)
- Technical Specifications, Volume 2 – Divisions 03 to 06 (January 2014)
- Technical Specifications, Volume 3 – Divisions 07 to 13 (January 2014)
- Technical Specifications, Volume 4 – Divisions 14 to 15 (January 2014)
- Technical Specifications, Volume 5 – Division 16 (January 2014)
- Technical Specifications, Volume 6 – Division 16 (January 2014)
- Technical Specifications, Volume 7 – Division 16 (January 2014)

3. Contract Drawings (December 2013)

The Contract Drawings are updated versions of selected Preliminary Engineering plan sheets that have been revised to reflect the current design and program requirements for Package B. The Contract Drawings supersede and replace any similar plans originally included in Volume 5 of the 100% Preliminary Engineering Drawings issued in November 2011.

The Contract Drawings also depict two project elements that may be added to the scope of Package B, depending on funding availability:

Add Alternate 1 – Warehouse Expansion. Design and construction of the future phase of the Warehouse Building as shown on Contract Drawings N99-RYS-P-100, N99-RYS-A-100, and N99-RYS-A-S102 to N99-RYS-S104, including:

- Deletion of the landscaping and connecting walkway and canopy included in the base Contract scope.
- Extension of the Warehouse Building foundations, floor, structure, building envelope, thermal & moisture protection, electrical, lighting, communications, mechanical and plumbing systems east to create a building of 47,000 gross square feet.
- Relocation of the east exterior wall of the Warehouse (presently shown along Column Line “WH”) so that it is coplanar with the Parts Room (101) Exterior Wall along Column Line “F,” as shown on N99-RYS-A-S111.
- Relocation of Fire Protection Room 103F to the Northeast corner of the expanded Warehouse.
- Deletion of Door 101C and adjacent air curtain. Doors 101E and 101D will provide access between Parts Room and the expanded Warehouse.

- No changes to Warehouse floor plan west of Column Line "WF"
- Interior partition between Master Plan Warehouse and Parts Room shall be full-height painted CMU.
- Additional pallet racks required in the expanded Warehouse will be furnished and installed by others.

Add Alternate 2 – Additional Hoists in S&I Building. Design and construction of additional railcar lifts and turntable for Track S-5, as shown on Drawing N99-RYS-102A.

- Design and construction of building modifications necessary to accommodate additional railcar lifts
- Modification of building foundations, pits, track, mechanical, electrical and plumbing as required to provide a completely functional installation.
- Procurement and installation of the following equipment:
  – Two (2) Additional In-Ground Rail Car Lifts identical in specification and functionality to other lifts provided in the Base Contract.
  – One (1) Manual Rail Truck Turntable identical in specifications and functionality to other turntables provided as part of the Base Contract.

4. Other Requirements:

- Dulles Corridor Metrorail Project – Phase 2, Quality Program Plan, Rev. 1 (March 2013)
- Dulles Corridor Metrorail Project – Phase 2, Safety and Security Management Plan, Rev. 0 (July 2013)
- Dulles Corridor Metrorail Project – Phase 2, Requirements for System Safety/Security Certification Management Plan, Rev. 2 (February 2013)

1.5.2 REFERENCE DOCUMENTS

In addition to the Project Technical Requirements, various reports and technical analyses were prepared during and after the completion of Preliminary Engineering for Phase 2. These documents are provided to the Contractor as supplemental information. These documents are intended to provide additional background on the PE design approach or existing site conditions, but do not define Contract requirements. The Contractor shall note that these documents were developed for all of Phase 2 and were based on alternative design for the Rail Yard and Maintenance Facility, and include references to other alignment and station alternatives considered during PE. Information provided in these documents may not accurately reflect previous or present conditions. Any such materials provided to the Contractor are for reference only and shall not be used as the basis for any proposal, design or construction activities without prior verification by the Contractor. The supplemental reference documents include:

1. Preliminary Engineering Reports:

- Basis of Design Report (November 2011)
- Final Accessibility Compliance Report (August 2011)
- Final Communication Radio Coverage Study (March 2011)
- Final Interface Control and Commissioning & Integration Testing Report (February 2011)
- Final Constructability Report (August 2011)
- Final Fire-Life Safety Report (September 2011)
- Preliminary Floodplain Impact Analysis Report (August 2011)
- Preliminary Engineering Geotechnical Data Report (April 2011)
- Final Site Investigation Report and Soil Contamination Report (January 2011)
- Final Soils Management Plan (June 2011)
- Preliminary Stormwater Management Report (September 2011)
- Final PE Traffic Analysis Compendium Report (September 2011)
- Preliminary Hazard Analysis (June 2010)

2. Environmental Documents:

- FTA Final Environmental Impact Statement for the Dulles Corridor Rapid Transit Project (December 2004)
- FAA Record of Decision – Dulles Corridor Metrorail Project at Washington Dulles International Airport (July 2005)
- FTA Amended Record of Decision – Dulles Corridor Metrorail Project, Fairfax and Loudoun Counties, Virginia (November 2006)
- Phase 2 PE Design Refinements Environmental Assessment (April 2012)
- FTA Finding of No Significant Impact – Dulles Corridor Metrorail Project, Phase 2 Preliminary Engineering Design Refinements, Fairfax and Loudoun Counties, Virginia (December 2012)
- FAA Finding of No Significant Impact/Record of Decision – Dulles Corridor Metrorail Project, Phase 2 at Washington Dulles International Airport (January 2013)
- Section 106 Memorandum of Agreement (October 2012)
- Virginia Department of Environmental Quality Virginia Water Protection Individual Permit 11-0193 dated June 10, 2011
- United States Army Corps of Engineers Department of the Army Permit (Section 404) NAO 2010-2277 dated June 15, 2011
- Virginia Marine Resources Commission) Permit VMRC #11-0193 dated October 18, 2011 (for crossings of Broad Run and Horsepen Run)
- Environmental Compliance Matrix (January 2014)

3. Phase 2 Preliminary Engineering Drawings:

- Preliminary Engineering Drawings, Volume 1 – Track and Line Structures (November 2011)
- Preliminary Engineering Drawings, Volume 2 – Civil (November 2011)
- Preliminary Engineering Drawings, Volume 3 – Stations and Facilities (November 2011)
- Preliminary Engineering Drawings, Volume 4 – Systems (November 2011)
- Preliminary Engineering Drawings, Volume 5 – Yard and Shop (November 2011)

4. Other Documents:

- Package B Contract Drawings (December 2013) – CAD Files
- Package A Yard Lead 60% Design Drawings (October 2013) – CAD Files
- Phase 2 Preliminary Engineering Drawings – Yard and Shop CAD Files (excluding Mainline, Stations, and Parking Garages)
- Package S Maintenance Facility Site Preparation – 100% Review Submittal Plans and CAD Files (January 2014)
- Dulles Corridor Metrorail Project – Phase 2 Communications and Outreach Plan, Rev. 1 (December 2012)
- WMATA Low Distortion Projection Survey Information and Supplemental Information (October 2012)
- WMATA Dulles Phase 2 Extension – Traction Power System Load Flow Study Simulation Report, Revision 1 (June 2013)
- WMATA Dulles Phase 2 Extension – Rail Potential Evaluation, Final Report (June 2013)
- VDOT Route 606 Reconstruction Project – RFP Plans (October 2013)

1.6 CRITERIA, CODES AND STANDARDS

The Contractor shall comply with all applicable Federal and state laws and regulations, Virginia and jurisdictional building codes, environmental regulations, WMATA and the Airports Authority requirements in completing the design, construction, installation, testing and acceptance, and turnover of Package B. The Contractor shall also comply with the policies and procedures of the jurisdiction responsible for issuing any permit required for the Contractor to perform its work. Any additional requirements identified in the FTA Amended Record of Decision (November 2006), the FTA Finding of No Significant Impact (December 2012), the FAA Record of Decision (July 2005), the FAA Finding of No Significant Impact/Record of Decision (January 2013), or subsequent revisions to these documents shall also apply.

The Contractor is responsible for determining and/or confirming all applicable criteria, codes, and standards for all aspects of the work and ensuring compliance with these requirements in completing the design, construction, and acceptance of Package B. Unless noted otherwise,

the Contractor must use the most current editions of the applicable criteria, codes and standards. The Contractor is responsible for identifying any conflicts or overlapping requirements among applicable standards and criteria. In the event that a clear order of precedence cannot be established, or a difference in the interpretation of the criteria, codes, or standards, cannot be resolved, the Contractor shall present the matter to the Airports Authority for a formal determination. Where conflicts or overlapping requirements exist, those of the agency or entity that will ultimately own and/or operate and maintain a given facility shall take precedence, unless otherwise approved by the Airports Authority. The absence of specific references to applicable criteria, codes or standards in this Statement of Work document, or elsewhere in the Project Technical Requirements, does not absolve the Contractor of the obligation to comply with this requirement. Unless otherwise noted, the Contractor shall verify and use the latest (most current) versions (or editions) of applicable design criteria, codes and standards.

The Contractor is also responsible for acquiring and utilizing any necessary criteria, codes, standards, manuals, instructions, or guidelines necessary to prepare the design, permitting, construction, and acceptance documents for Package B. If, during the course of design, the Contractor determines that a specific design criteria, code or standard not listed here is required, it is the responsibility of the Contractor to identify the pertinent document(s) and submit to the Airports Authority for approval prior to their use, including an evaluation of the impact of its incorporation into the project.

Any deviations or variances from applicable criteria, codes, or standards shall be identified and submitted for approval. Approval shall be obtained prior to the completion of design.

1.6.1 DESIGN CRITERIA

The Contractor shall be responsible for determining and/or confirming all applicable design criteria requirements for all aspects of the work, elevating and resolving any conflicting requirements and ensuring compliance with established requirements in completing the design, construction, and acceptance of Package B. Final determination of the applicability for conflicting requirements among criteria shall be at the sole discretion of the Airports Authority. The following criteria represent the minimum requirements that shall be met.

The design standards and criteria for all WMATA facilities in Package B are established by the "WMATA Design Criteria and Requirements" (WMATA Design Criteria) which consist of: a) the WMATA Manual of Design Criteria for Maintaining and Continued Operation of Facilities and Systems, Release 9 (May 2008), b) applicable WMATA Standard and Design Drawings, Release 9 (Various Dates), c) the Summary of Technological Enhancements to Release 9 of the WMATA Design Criteria (March 2010), and d) applicable WMATA safety and security Requirements, as modified by approved deviations (WMATA Design Standard Change Proposals) and changes allowed by the Airports Authority-WMATA Cooperative Agreement.

WMATA Standard (ST) Drawings are system-wide standards and shall be used by the Contractor, where appropriate, to develop design details for Package B. WMATA Design (DD) Drawings (which include WMATA's Architectural Standard Details) are example solutions and shall be used by the Contractor, where appropriate, to develop design details for Package B except where shown otherwise in the Contract Drawings. The WMATA ST and DD Drawings

shall be reviewed by the Contractor to determine applicability. The Contractor shall either adopt or adapt applicable details into its design and construction plans. The WMATA ST or DD Drawings shall not be used for construction purposes.

The Airports Authority's Design Manual (2010) establishes design standards and criteria for all construction projects at Dulles Airport (including the DIAAH), as well as policies and procedures related to Airport operations, security, airside access, and other work restrictions. The Contractor shall note that the requirements of the Airports Authority Design Manual maybe more restrictive or stringent than requirements of other jurisdictions. Design and construction of those facilities that will be owned and maintained by the Airports Authority (such as roadways, parking lots, drainage facilities, utilities, landscaping, signage, and fencing) shall be in accordance with the Airports Authority Design Manual. Within the boundaries of Dulles Airport, the design and construction of those facilities to be owned and maintained by WMATA, including the Rail Yard and Maintenance Facility shall be designed and constructed in accordance with the WMATA Design Criteria.

1.6.2 CODES AND STANDARDS

The Contractor is responsible for determining and/or confirming the applicable codes and standards for all aspects of the work, elevating and resolving any conflicting requirements and ensuring compliance with the established requirements in completing the design, permitting, construction, and acceptance of Package B. Final determination of the applicability for conflicting requirements among codes and standards shall be at the sole discretion of the Airports Authority. The Contractor shall refer to specific design requirements mandated by applicable Virginia and Federal law. Where specific documents or standards are incorporated by reference into a law or administrative code, the Contractor shall use the most recently adopted version of that document or standard. The Contractor shall be responsible for identifying the need for and preparing any code or standard modification requests to the appropriate agency, jurisdiction or governing body.

In addition to the codes and standards that are legally required, the Contractor shall design and construct the Project in accordance with the following:

American Association of State Highway and Transportation Officials (AASHTO)

- A Policy on Geometric Design of Highways and Streets
- Standard Specifications for Highway Bridges, 17th Edition (for utilities)
- Guide for the Design of Pavement Structures
- Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals

American Concrete Institute (ACI)

- Building Code Requirements and Specifications for Masonry Structures, ACI 530, by ACI and the Masonry Joint Committee (2008, use only the ASD method)
- Building Code Requirements for Reinforced Concrete, ACI 318-08

- Manual of Standard Practices for Detailing Reinforced Concrete Structures, ACI 315
- Building Code Requirements for Reinforced Concrete, ACI 318-99 (Appendix A – Alternate Design Method)
- Specifications for Structural Concrete for Buildings, ACI 301

American Railway Engineering and Maintenance-of-Way Association (AREMA)

- Communications and Signals Manual of Recommended Practices
- Manual for Railway Engineering
- Portfolio of Track Work Plans

Federal

- 14 CFR Part 77, Objects Affecting Navigable Airspace
- 23 CFR 625, National Highway System Design Criteria and Standards
- Federal Aviation Administration Advisory Circulars:
  - AC 150/5200-33, Hazardous Wildlife Attractants on or near Airports
  - AC 150/5300-13, Airport Design
  - AC 150/5370-2, Operational Safety on Airports During Construction
- US Department of Transportation, Federal Highway Administration Directives and Policy Memorandums
- US Department of Transportation, Federal Transit Administration Directives and Policy Memorandums

Metropolitan Washington Airports Authority (Airports Authority)

- Construction Safety Manual (July 2002)
- Airports Authority Design Manual (2010)

National Fire Protection Association (NFPA)

- NFPA 101 Life Safety Code
- NFPA 130 Standard for Fixed Guideway Transit and Passenger Rail Systems
- NFPA 220 Standard on Types of Building Construction

National Oceanic and Atmospheric Administration

- Technical Memorandum NOS NGS-58 (Guidelines for Establishing GPS-Derived Ellipsoid Height, 1997)
- Technical Memorandum NOS NGS-59 (Guidelines for Establishing GPS-Derived Orthometric Heights, 2008)

Northern Virginia Planning District Commission

- Northern Virginia BMP Handbook: A Guide to Planning and Designing Best Management Practices in Northern Virginia

U.S Green Building Council

- Leadership in Energy and Environmental Design (LEED) Standards, as applicable

Utility Owner Standards

Utility design and relocation work performed by the Contractor shall be in compliance with the latest standards of the utility owners.

Virginia Department of Environmental Quality

- Virginia Erosion and Sediment Control Handbook
- Virginia Erosion and Sediment Control Technical Bulletins (1 through 4)
- Virginia Land-Disturbance Guidance for Telephone, Cable, Electric, Natural Gas Pipeline and Railroad Companies
- Virginia Stormwater Management Handbook
- Virginia Stormwater Management Program - Technical Bulletins (1 through 8)
- Variance Requests for Utility, Pipeline, and Railroad Projects: Guidance for Completing a Project-Specific Erosion and Sedimentation Control Plan

Virginia Department of Health

- Sewage Collection and Treatment Regulations

Virginia Department of Housing and Community Development

- Virginia Uniform Statewide Building Code – VUSBC (2009)

Virginia Department of Transportation (VDOT)

- Standards, Specifications, Reference Manuals, Special Provisions and Supplemental Specifications Applicable to the Design and Construction of VDOT Facilities

Washington Metropolitan Area Transit Authority

- WMATA CADD Standards (March 2012)
- WMATA Manual of Design Criteria for Maintaining and Continued Operation of Facilities and Systems, Release 9 (May 2008)
- WMATA Summary of Technological Enhancements to Release 9 of the WMATA Design Criteria (March 2010)
- WMATA Standard and Design Drawings, Release 9 (Various Dates)

- WMATA System Safety Program Plan (January 2011)
- WMATA Metrorail Safety Rules and Procedures Handbook (April 2011)
- WMATA Manual for Technical Specifications and Requirements for Systemwide Surveying and Mapping Services – Metro Extension (March 2011)
- WMATA Signage Standard Manual (March 2008)
- WMATA Station Site and Access Planning Manual (May 2008)
- WMATA Adjacent Construction Project Manual, Revision 4 (February 2010)

Other Design Standards

- American Institute of Steel Construction (AISC): Steel Construction Manual
- American National Standards Institute (ANSI)
- American Society of Civil Engineers (ASCE): Minimum design loads – Minimum Design Loads for Buildings and Other Structures, ASCE 7
- American Society of Testing and Materials (ASTM)
- American Welding Society (AWS) Welding Code D 1.1and D 1.4
- ANSI/ASHRAE/IES Standard 90.1 – Energy Standard For Buildings Except Low-Rise Residential Buildings
- Illuminating Engineering Society of North America (IESNA) Handbook
- Institute of Electrical and Electronics Engineers (IEEE) including C37, C51, C34
- International Energy Code IECC, Commercial Energy Code Compliance, Chapter 8, Section 802, Envelope Requirements.
- Manual of Uniform Traffic Control Devices (MUTCD)
- National Electrical Code (NEC)
- National Electrical Manufacturers Association (NEMA) standards
- National Electrical Safety Code (NESC)
- Post-Tensioning Institute: Post-Tensioning Manual
- Precast Prestressed Concrete Institute: PCI Design Handbook
- Underwriters Laboratory (UL)

1.6.3 DESIGN DEVIATIONS OR EXCEPTIONS

The Project Technical Requirements incorporate deviations from the applicable WMATA criteria and standards (Design Standard Change Proposals) that may be utilized in the Contractor's design for Package B. Additional details are provided in **Appendix 2** (Approved WMATA Design Deviations).

For any deviations not yet approved by WMATA, the Contractor shall first attempt to eliminate the deviation during design development by proposing an alternative design that meets the applicable criteria and/or standards. If unsuccessful, the Contractor shall take the steps

necessary to obtain approval of the WMATA DSCPs requests in accordance with the Contract Documents. The Contractor shall not assume that approval will be granted and shall expect an iterative review process.

If warranted and determined to be necessary to successfully deliver Package B, the Contractor shall identify necessary deviations to the applicable design criteria, codes and standards and document and obtain approval for these deviations from the appropriate agency or jurisdiction prior to beginning the work.

1.7 PERMITTING

1.7.1 PERMITTING TASKS AND RESPONSIBILITIES

The Contractor shall be responsible for determining and obtaining (on behalf of the Airports Authority where applicable) all permits necessary for the temporary and permanent construction of Package B. The Contractor's general responsibilities are listed in Table 1; additional permitting responsibilities and requirements are identified in the Contract Documents.

Table 1-1. Permitting Tasks and Responsibilities

Task Description	Contractor Responsibility
Confirm temporary and early (long-lead) permits and establish permit schedule	Lead
Initiate temporary and early (long-lead) permits	Lead
Prepare the finalized list of permits and approvals required, packaged as per the requirements of the Contract and incorporate into the Baseline Schedule	Lead
Conduct environmental awareness and permit training for all Contractor and subcontractor staff	Lead
Prepare drawings and calculations for permit applications; determine alternatives to minimize impacts and permit conditions	Lead
Prepare the Environmental Management Plan, training, and compliance documents/tools (e.g., training handouts, drawings, mitigation plans)	Lead
Confirm that designs and construction plans incorporate regulatory requirements and comply with existing permits	Lead
Progressively submit and track permit applications according to sequential design packages and construction schedules	Lead
Report permit tracking and look-ahead at Progress Meeting(s) with Airports Authority throughout the design-build process	Lead
Coordinate working meetings with agencies to review project designs, plans, and status throughout the design-build process	Lead
Identify any need to modify existing permits for which the Airports Authority is the permittee; prepare revised drawings, calculations, and alternative analyses as required to support the application for modification.	Lead
Request modification to existing Owner permits based on Contractor's design or construction plans	Support Airports Authority
Update and maintain FTA mitigation tracking table	Support Airports Authority
Conduct field compliance inspections and monitoring; coordinate with regulatory inspectors	Lead

Task Description	Contractor Responsibility
Document environmental commitments and compliance during construction, including periodic updating and maintaining of the Environmental Compliance Matrix	Lead
Conduct permit close-out for Owner permits	Support Airports Authority
Conduct permit close-out for design-build permits sought by Contractor under the Airports Authority's name	Lead
Conduct permit close-out for design-build permits issued directly to Contractor	Lead

1.7.2 ENVIRONMENTAL PERMITS

Environmental permits and/or approvals to be obtained by the Contractor shall include, but may not be limited to, those listed in Table 2. Omission of any required environmental permits from this Statement of Work shall not absolve the Contractor from the responsibility of obtaining the permits necessary to construct Package B.

Table 1-2. Summary of Required Environmental Permits and Approvals

Any Modifications of Owner permits from U.S. Army Corps of Engineers, Virginia Department of Environmental Quality (VDEQ), and Virginia Marine Resources Commission (VMRC)*
VDEQ Virginia Pollutant Discharge Elimination System (Permanent) General Permit (may need individual permit(s) as per VDEQ)
VDEQ Minor New Source Review Permits/VDEQ Emergency Generator General Permits
Airports Authority Erosion and Sediment Control Plans and Stormwater Management Plan)
VDEQ General Permit for Discharges of Stormwater from Construction including Stormwater Pollution Prevention Plan
Notification of Regulated Waste Activity (EPA Hazardous Waste Generator ID Number)
Contractor action–related VDEQ Corrective Action Plan Approvals
VDEQ Chesapeake Bay Program Approval, including Water Quality Impact Analysis
Other permits, approvals, and notifications that may be needed for permanent and temporary construction activities performed by the Contractor and/or its subconsultants and suppliers

* One Joint Permit Application was submitted to USACE, VMRC, and VDEQ during PE and resulted in issued permits from each of these agencies (see Section 1.6.4). The Contractor is responsible for any permit modifications required during design and construction.

1.7.3 BUILDING AND CONSTRUCTION PERMITS

Construction permits and/or approvals to be obtained by the Contractor shall include, but may not be limited to, those listed in Table 3. Omission of a required building or construction permit from this table shall not absolve the Contractor from the responsibility of obtaining it.

Table 1-3. Summary of Required Construction Permits and Approvals

Federal Aviation Administration Work Approval(s)
WMATA Site-Specific Work Plan Approvals
Virginia Department of General Services (DGS) Building Permits
Airports Authority Construction Permits
Airports Authority Building and Occupancy Permits
Airports Authority and Loudoun County Fire Prevention Reviews and Approvals
Gas and Electric Utilities Connection Approvals
TRIP II Transit Development and Utility Permits
VDOT Land Use Permits
Airports Authority, VDOT and/or Dulles Greenway Maintenance of Traffic Approvals
Loudoun County and DC Water Sewer & Water Connections Approvals
Loudoun County Wastewater Discharge Permit
Loudoun County Utility Permits
Virginia Department of Housing and Community Development Virginia Registration Seal for industrialized/modular buildings
All other permits, approvals, and notifications that may be needed for permanent and temporary construction activities performed by the Contractor and/or its subconsultants and suppliers.

1.7.4 ADDITIONAL PERMITTING REQUIREMENTS

Wetlands Delineation and Section 404 Permits. The Airports Authority coordinated with the Virginia Department of Environmental Quality (VDEQ) and the US Army Corps of Engineers (USACE) in obtaining a new Jurisdictional Determination (JD) for new wetlands and streams recently identified and all wetland boundaries within the project limits. This JD was verified by the USACE in a letter dated September 30, 2010 (USACE Project Number 2010-2277). Based on the JD and a submitted Joint Permit Application, the Airports Authority obtained the following permits:

- VDEQ Virginia Water Protection Individual Permit 11-0193 dated June 10, 2011
- USACE Department of the Army Permit (Section 404) NAO 2010-2277 dated June 15, 2011
- Virginia Marine Resources Commission Permit (VMRC #11-0193) dated October 18, 2011 (for crossings of Broad Run and Horsepen Run)

The Contractor shall be responsible for compliance with all conditions contained in these permits, and is not allowed to exceed the permitted permanent impacts for wetlands within the limits of disturbance used as the basis of the above permits.

VSMP Permit, Erosion and Sediment Control Plan and Stormwater Management Plan Approvals. During the fourth quarter of 2014 and in coordination with the Package S Contractor, the Package B Contractor shall obtain a VSMP Permit for the soil stockpile site as depicted in the Package S plans. The Contractor shall also obtain approval of an Erosion and

Sediment Control (E&SC) Plan and a Stormwater Management (SWM) Plan to maintain the existing temporary E&SC controls and temporary SWM facilities at the soil stockpile site.

Prior issuance of the associated permit/approvals, the Package B Contractor, VDEQ, Airports Authority and Package S Contractor will perform an inspection and develop a punchlist of any remaining items to be addressed by the Package S Contractor prior to turnover of responsibility to the Package B Contractor. At such time as all items are satisfactorily addressed, a permit approval will be issued to the Package B Contractor, and a Notice of Termination will be issued to the Package S Contractor.

The Contractor shall later obtain a VSMP Permit and E&SC and SWM Plan approvals for the entire Package B site based on the Contractor's final design as required in the Project Technical Requirements.

1.8 JURISDICTIONAL BOUNDARIES

The Contractor must comply with the requirements of multiple agencies and local jurisdictions, including, but not limited to: the Airports Authority, WMATA, Virginia Department of Transportation, and other federal and state agencies (e.g., Federal Transit Administration, Federal Aviation Administration, US Army Corps of Engineers, Virginia Department of General Services (DGS), and the Virginia Department of Environmental Quality (DEQ)). One or more of these agencies may review or oversee the Contractor's work.

For all facilities, the appropriate building code official will be the Authority Having Jurisdiction (AHJ) and will be responsible for code approval of the work. With the exception of traction power substations and tie-breaker stations, the Airports Authority Building Code Department has jurisdiction for design reviews, building permits, applicable inspections, certificates of occupancy, and enforcement of building codes. For the, traction power substations and tie-breaker stations included in Package B, the Virginia DGS is the AHJ and is responsible for building code enforcement and associated inspections.

VDOT will review designs and permit applications and issue permits and approvals for construction and construction-related activities on VDOT right-of-way.

The Airports Authority Building Codes & Environmental Department will permit the design and construction of facilities related to erosion and sediment control and stormwater management.

Federal Aviation Administration permits will be required for construction activities within and adjacent to the boundaries of Dulles Airport.

1.9 KEY PROJECT INTERFACES

The Contractor shall be responsible for the definition, design, construction, and management of all interfaces with WMATA facilities and systems, Airports Authority facilities (including the Dulles Airport) and systems, Package A and other entities' facilities and systems required to successfully deliver Package B. These interfaces include, but are not limited to the following:

- Interfaces among the various systems, subsystems, equipment and facilities within the Package B work scope.

- Coordination of the Interfaces between the Contractor-provided systems, subsystems, equipment and facilities, and existing WMATA systems, subsystems, equipment, structures and facilities. These interfaces include those provided by the Package A contractor.
- Interfaces between the Contractor-provided systems, subsystems, equipment and facilities and existing Airports Authority systems, subsystems, equipment, structures and facilities.
- Interfaces between the Contractor-provided systems, subsystems, equipment and facilities and existing infrastructure, including roadways, drainage and utilities.
- Interfaces with the VDOT Route 606 Reconstruction Project Contractor.
- Interfaces with the Package S Contractor.

All necessary physical, electrical, mechanical and operational interfaces to complete Package B shall meet specified service levels and performance standards and not interfere with the continued operation of existing systems, facilities, and equipment. Interface control documents, including integration drawings, shall be developed to comprehensively define all interfaces within Package B, as well as the work required for all interfacing parties to achieve seamless integration of the Phase 2 facilities, systems, equipment, and software. The Contractor shall develop and administer a Systems Division of Responsibility matrix. The purpose of this matrix is to identify the areas where the design and/or construction of Package B systems will result in interactions, dependencies and demarcations among the Airports Authority, WMATA and the Contractor, and to define each party's responsibilities in the development of fully functional and safe rail systems and subsystems.

Additional details on interface requirements for Package B are provided in **Appendix 3** (Contract Package Interfaces) of this Statement of Work.

1.9.1 INTERFACE WITH PACKAGE A

The interfaces between Packages A and B involve numerous disciplines, systems and subsystems. The Package A Contractor shall identify, define, and manage all necessary interfaces between Package A and Package B, including those necessary for full integration of the yard lead tracks and rail yard abutment designs, track alignment and elevations, and systems connectivity. Required interface coordination and management shall continue throughout the design and construction of Package B.

The Contractor shall coordinate all necessary interfaces with Package A and the existing WMATA Metrorail system. Interface(s) with Package A and the existing WMATA system are primarily related to infrastructure and equipment in the vicinity of the east end of the yard lead tracks and structure.

The Package A – Package B interfaces will include:

- A fiber optic patch panel in the TBS #9/TCR N99E Communications room.
- A copper DTS patch panel in the TBS #9/TCR N99E Communications room.
- Lining and profiling the completed Package B track to match the Package A design

Additional details on the interface limits and requirements are provided in **Appendix 3**

The Contractor shall perform all work and provide all equipment required for tie-in connections at the TBS#9/TCR N99E communications room. This shall include all necessary additions, deletions and modifications to the existing circuitry, tagging and programming.

1.9.2 INTERFACE WITH EXISTING WMATA SYSTEMS

The Contractor shall define, design, construct, and manage all necessary interfaces with existing WMATA systems. This work shall be fully coordinated and shall involve exchanges of information, data and other work products to successfully achieve integration of Package B within the WMATA rail network.

The Contractor shall identify and define additional system interfaces at the Jackson Graham Building and the Carmen Turner Facility, including the Advanced Information Management system (AIM) and Automated Energy Management System (AEMS) and Building Automation Systems (BAS). Consideration of the need for additional interfaces shall be determined by a review of WMATA's existing operational systems and procedures by the Contractor in collaboration with the Airports Authority and WMATA, recognizing that existing systems and procedures are already designed to work in support of the needs of local entities. All design and implementation work on existing WMATA Operations Control Center equipment will be performed by WMATA.

WMATA systems interfaces are the Train Control, Traction Power and Communications systems:

- The Package B Yard Train Control (YTC) System shall interface with the WMATA ATC System at the N99E TCR and Communications room as shown in **Appendix 3** of this Statement of Work. The YTC/ATC System interface performance and functionality shall be in accordance with the requirements of the Project Technical Requirements.
- The Package B Traction Power System (TPS) shall interface with WMATA TPS at the TBS #9/TCR N99E Communications room. TPS System interface performance and functionality shall be in accordance with the requirements of the Project Technical Requirements.
- The Package B Communications System shall interface with WMATA's existing LAN/WAN System at the TBS #9/TCR N99E Communications room. The Package B LAN/WAN will utilize existing fiber optic cables for connections, as required, to WMATA's "main core data switches" at the Metro Center and Gallery Place passenger stations. The Communications System shall also interface with WMATA's existing Comprehensive Radio Communications System and local jurisdictional emergency service radio systems where surface radio coverage shall be extended into the new facilities.
- The Contractor shall provide 480-volt AC power for TBS #9, TCR N99E, and any other facilities at that location. The specific power requirements shall be coordinated with the Package A Contractor.

- The Contractor shall develop a testing and acceptance plan for Package B that accomplishes a seamless connection to the Package A line while minimizing required outages and track rights. The Contractor is required to maximize the work performed during outages and track rights granted by WMATA.

- The Contractor shall complete all necessary testing in accordance with WMATA access, adjacent construction and work rules.

1.9.3 INTERFACES AT DULLES AIRPORT

The Contractor shall define, design, construct, and manage all necessary interfaces with existing Airports Authority facilities at Dulles Airport. The Airports Authority Design Manual establishes procedures and sets standards for Dulles Airport in order to achieve consistency in all design and construction projects related to the Airports Authority and its tenants. Airport interfaces that include, but are not limited to:

- Site work and existing utilities.
- Civil work relating to utility corridor/ductbank design coordination, storm water, water mains, sanitary sewer, and dust control.
- Coordination with existing and proposed roadway infrastructure.
- Locations of wayside buildings and other surface infrastructure.
- Maintenance of vehicular and pedestrian traffic.
- Runway Approach Zone restrictions and requirements.
- Security.

1.9.4 INTERFACES WITH VDOT

The Contractor shall define, design, construct, and manage the necessary physical and systems interfaces between Package B and existing and planned VDOT facilities, including the Route 606 Reconstruction Project, and ensure that these facilities remain open and operational during the construction period.

VDOT will have a design-build contractor performing a reconstruction project on Route 606 adjacent to the Package B site. The scope of this project is depicted in the VDOT RFP Plans provided with this RFP. A Notice to Proceed for this contract is expected to be issued in the third quarter of 2014. The interfaces between Package B and the Route 606 project include:

- The emergency access driveway which is to be constructed by VDOT up to the point as shown in the VDOT RFP Plans.
- The elimination of the existing driveway entrance into the Maintenance Facility Site and the construction of the new driveway entrance, both of which are to be performed by VDOT. The Package B Contractor shall coordinate with VDOT and VDOT's Design-Builder on the timing of VDOT's construction of the new driveway entrance to the Maintenance Facility Site and VDOT's closure of the existing driveway. Once VDOT has constructed the new driveway entrance and is preparing to close the existing entrance, the Contractor shall perform any needed construction,

whether temporary or permanent, at the tie-in/interface point of the new entrance such that the Contractor can then use the new entrance location as the sole entry point to the Maintenance Facility Site, and VDOT can close the existing entrance. The timing for construction and closure of these entrances is at VDOT's discretion.

- The tie-in point for new utility services. As part of the Route 606 reconstruction project, VDOT will be relocating existing utilities along the 606 corridor. The Contractor shall coordinate with VDOT on the connection point for new utility services to the Maintenance Facility Site based on where the relocated utilities will be placed. The Contractor shall coordinate with VDOT on the timing of the installation of the new utility services for the Maintenance Facility Site.

1.9.5 INTERFACES WITH PACKAGE S

The Contractor shall define, design, construct, and manage the necessary physical and systems interfaces between Package B and Package S.

At the time of Package B NTP, a portion of the Maintenance Facility Site will be under control of the Package S Contractor that is performing soil stockpile removal on the portion of the Maintenance Facility Site shown in Package S 100% Design Plans provided with this RFP. Upon completion of the soil stockpile removal and stabilization of the site by the Package S contractor, it is the Package B Contractor's responsibility to take over control and maintenance of the temporary Erosion and Sediment Controls and Stormwater Management facilities and acquire the associated permits/approvals from the Airports Authority and/or DEQ during the fourth quarter of 2014. Additional information regarding the permits is provided in section 1.7.4 of the Statement of Work.

The Package S Contractor will still be mobilized on the Maintenance Facility Site and accessing the site daily until the end of 2014. The Package B Contractor shall allow for this and coordinate any early survey and design activities with the Package S Contractor.

1.9.6 INTERFACES WITH DOMINION VIRGINIA POWER

The Contractor shall design, construct, and manage all interfaces between the 34.5 kV power distribution system and all other elements of Package B facilities with Dominion Virginia Power (DVP). Specific interfaces include, but are not limited to:

- The single DVP power feeder from the Dulles substation at the interface point defined by the Package A Contractor.
- The single DVP power feeder from the Shellhorn substation at the interface point defined by the Package A Contractor.

The Contractor shall connect to the two 34.5 kV feeder cables in the interface manhole provided by the Package A contractor. The Contractor shall provide all electrical splices in the interface manhole and the switch at TPSS #18 to the feeders provided by the Package A contractor.

1.9.7 OTHER INTERFACES

Other design and construction projects within or adjacent to the limits of Package B will occur concurrently with the Contractor's design-build activities. The Contractor is responsible for identifying any applicable Package B interfaces and ensuring that its design and construction activities are properly coordinated with any adjacent projects by the Airports Authority, VDOT, TRIP II, or Loudoun County. The Contractor shall also coordinate its design and construction activities with Loudoun Water's planned new Potomac Interceptor sanitary sewer line.

1.10 PRELIMINARY ENGINEERING DESIGN COMMENTS

Some comments (see **Appendix 4** - Unincorporated Design Comments) generated by the Airports Authority, WMATA, and Loudoun County during the completion of the PE design or the development of the RFP documents were deferred to the Design-Build phase for resolution. The Contractor shall be responsible for developing appropriate resolutions and/or incorporating the indicated responses into its design and construction of Package B

1.11 PROPERTY ACQUISITION

The property limits identified in the Project Technical Requirements for Package B facilities and equipment have been determined to be sufficient and may be used as required by the Contractor to accomplish the Work. If required, the Contractor shall be responsible for providing and acquiring all other land area(s) needed for materials storage, laydown, field offices, equipment, temporary facilities and other similar aspects of the Work.

1.12 LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN EVALUATION

WMATA has established a goal that all new and substantially rehabilitated WMATA facilities achieve at least a "Silver" rating in Leadership in Energy and Environmental Design (LEED) from the U.S. Green Building Council. As further described in Section 3.2.1 of this Statement of Work, three Package B facilities shall achieve LEED Silver Certification.

Within 90 days of NTP, the Contractor shall complete an evaluation of Package B scope and provide a plan detailing the process it will follow to achieve LEED certification for these facilities at the Silver level. This evaluation shall assess: a) specific options for the use of environmentally-friendly materials and construction techniques, b) measures that could be adopted to reduce energy consumption, as well as demolition and construction waste, and b) opportunities to promote better indoor air quality and access to daylight and views. A completed LEED Checklist shall be included. Per WMATA direction, vegetated roofs shall not be used.

SECTION 2. RAIL YARD

2.1 SURVEY AND MAPPING

2.1.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall be responsible for conducting all survey work necessary to perform the design, construction, and record documentation of all aspects and elements of Package B using WMATA's 2009 Low Distortion Projection (LDP) Coordinate System. Any PE design information or CAD files prepared in any other coordinate system utilized by the Contractor shall be updated to the new coordinate system.

Prior to the start of construction for Package B, the Contractor shall survey the existing monuments using WMATA's 2009 LDP Coordinate System and re-establish any monuments that have been destroyed or disturbed. There are two survey control points located along Route 606 in the vicinity of the Package B site shown in the Reference Documents.

All Contractor designs shall reference the WMATA 2009 LDP Coordinate System. Other Project stakeholders, including the Airports Authority (Aviation), VDOT, Fairfax County and Loudoun County use the Virginia State Plane Coordinate System. All documents required by these jurisdictions shall additionally reference the Virginia State Plane Coordinate System.

All existing survey controls were originally documented in the WMATA Project Grid Coordinate System but most have since been converted to WMATA's 2009 LDP Coordinate System. The Package B PE design was prepared based on the WMATA Project Grid system.

2.1.2 ADDITIONAL SURVEY AND MAPPING REQUIREMENTS

The Contractor shall also comply with the following requirements when conducting and completing surveys related to Package B:

a. Deliverables that require the presentation of survey information shall be provided in two datasets that are identical in all aspects except horizontal.

b. One dataset shall be provided in the WMATA 2009 LDP Coordinate System using the following parameters:

   - Coordinates shall be recorded in decimal US Survey feet.
   - Horizontal coordinates shall be based on the North American Datum of 1983 (NAD83) and the National Spatial Reference System of 2011 (NA2011).

c. The second data set shall reference coordinates in the Virginia State Plane North Coordinate System using the following parameters:

   - Coordinates shall be recorded in decimal US Survey feet.
   - Horizontal coordinates shall be based on the North American Datum of 1983 (NAD83) and the Geographic Reference System (GRS 80) ellipsoid.

- All vertical measurements shall be recorded based on North American Vertical Datum of 1988 (NAVD 88) and measured in feet above datum.

d. The Contractor shall maintain the network of horizontal and vertical control monuments along Route 606 as shown in the Reference Documents. Monuments or supplemental control points that are missing, displaced or lost for any reason shall be re-established as soon as practical. Monuments and supplemental control points shall be re-established in the vicinity of the original position in order to maintain the sight lines of adjacent monuments, unless impractical to do so.

e. The Contractor shall develop a digital terrain model based on the updated surveys and utilize this model as necessary in its work. This work shall be performed after the soil stockpiles have been removed from the site by the Package S Contractor. CAD files will be provided from the Package S Contractor that document the proposed conditions following the soil removal, but it will be the responsibility of the Package B Contractor to verify all information provided and modify its work to reflect actual conditions following the soil removal.

f. The Contractor shall verify, using field surveys, the locations and configuration of underground and overhead utilities, and other similar potential obstructions shown in the Project Technical Requirements or discovered by the Contractor during design and construction. The Contractor shall provide record documentation of these verifications.

g. Any required background files for existing and proposed facilities shall be coordinated with the appropriate agencies by the Contractor upon request.

2.2 GEOTECHNICAL

2.2.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall be responsible for all geotechnical investigations, analyses, and determinations necessary to complete all aspects and elements of Package B. The Contractor is also responsible for coordinating and integrating the geotechnical data and requirements with all other disciplines to ensure a fully integrated design. The Contractor shall conduct and document geotechnical investigations for Package B in accordance with the Project Technical Requirements and applicable criteria, codes and standards, and prepare a final Geotechnical Design Report and Geotechnical Data Report.

At a minimum, the Contractor shall conduct subsurface exploration and investigations at the following locations in accordance with the applicable AASHTO, AREMA and VUSBC requirements and prepare report(s) necessary to document the findings and substantiate the proposed designs:

- All locations where tracks will be constructed, including areas for future expansion.
- All structures, including buildings and retaining walls.
- All proposed stormwater management (SWM) facility locations.
- All proposed utility crossings, including proposed utility jacking pits and along the alignment as necessary to define the subsurface conditions for use in jack and bore, micro tunneling, directional drilling or any other technique utilized to cross under roadways, facilities, and any other areas where cut and cover construction methods are not permitted.
- All TPSS and TCR locations.
- All new and/or modified roadways. Perform a design-level geotechnical investigation to validate and augment the geotechnical information included in this RFP. The geotechnical engineering investigation performed by the Contractor shall meet or exceed applicable WMATA, VDOT, or VUSBC requirements.
- Steep slope areas.

The Contractor shall perform additional borings within the limits of Package B necessary to support their engineering analyses, design, and construction of the work. All borings for deep foundations shall meet AASHTO Bridge Design Specification boring depth requirements.

The PE Geotechnical Evaluation Report – Yard and Shops Supplement (January 2013) provided in **Appendix 5** establishes the baselines for assumed geotechnical conditions. In addition, the core samples collected during the completion of Phase 2 PE are available for inspection and evaluation. Additional Phase 2 geotechnical samples from prior studies are also available for the Contractor's reference. The Contractor is responsible for any additional geotechnical investigations necessary to complete Package B.

2.2.2 ADDITIONAL GEOTECHNICAL REQUIREMENTS

The Contractor shall also comply with the following requirements when conducting geotechnical investigations or completing geotechnical designs related to Package B:

a. The Contractor shall be responsible for any additional related activities such as locating utilities, permits, maintenance of traffic, etc.

b. The Contractor shall prepare a geotechnical field investigation plan for all field work. This work shall be properly permitted and approved by the property owner or the appropriate agency.

c. The Contractor's geotechnical report(s) shall include, but not necessarily be limited to, recommendations for temporary shoring; dewatering; excavation methods; an analysis of the proposed excavation with respect to the adjacent roadway and facilities that it will impact, including settlement and loss of ground; effects on existing utilities; effects on adjacent improvements and structures; noise and vibration effects; recommended foundation types; allowable bearing capacities; allowable settlements; anticipated settlements; hydrostatic pressure considerations; slope stability calculations, and lateral load capacities. All work within or adjacent to the WMATA right-of-way or WMATA facilities shall be performed in accordance with approved Right of Entry and with the requirements of WMATA's Manual of Adjacent Construction.

d. Test borings for deep foundations shall extend a minimum of 20 feet below the anticipated tip of any drilled shaft or pile. For drilled shafts extending into rock, the rock cores shall extend a minimum of 10 feet or three times the shaft diameter below the anticipated bottom of shaft for single (isolated) shafts or two times the maximum shaft group dimension below the anticipated bottom of shafts for a shaft group, whichever is greater.

e. For new and/or modified roadways, design and construct pavements, subgrades, and embankments to meet the following post-construction settlement tolerances:

   - Total vertical settlement less than two inches over the initial 20-years, and less than one inch over the initial 20-years within 100 feet of bridge abutments.
   - Settlement that will not impede positive drainage of the pavement surface, especially within the travel lanes, or subject the roadway to flooding.
   - Settlement that does not result in damage to adjacent or underlying structures, including utilities.
   - For pavement sections and tie-ins to the Project, grade tolerances shall be measured with a 10-foot straightedge. The variation of the surface from the testing edge of the straightedge between any two contacts with the surface shall not be more than plus (+) 0.25-inch to minus (-) 0.125-inch at structures and (+/-) 0.25-inch at project tie-ins.

2.3 LINE AND TRACK

2.3.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall design, furnish, install or construct, and test all track systems, equipment, and facilities necessary to deliver a complete, safe, and operational rail yard for Package B in accordance with the Project Technical Requirements and applicable criteria, codes, and standards. This work includes, but is not limited to: finalization of the rail alignments, track and track component design, supply and installation, integration of all track and special trackwork components, installation and testing of the electrified rail for power supply, and the yard train control system. The overall design and construction shall also include preparation of subgrade, retaining wall construction, grading and backfilling, design and installation of track drainage system, and construction of sub ballast and ballast. The Contractor is responsible for coordinating the line and track design and construction with all other disciplines to ensure a fully integrated Package B.

With respect to WMATA Standard (ST) Drawings and/or WMATA Design (DD) Drawings provided with the RFP, the Contractor is advised that WMATA has not updated these drawings for designs associated with the use of concrete cross ties and concrete special trackwork ties. The Contractor shall either adopt or adapt applicable details of WMATA ST and/or DD Drawings into its design plans and submit the plans for approval.

2.3.2 ADDITIONAL LINE AND TRACK REQUIREMENTS

The Contractor shall also comply with the following requirements when designing and constructing the line and track elements in Package B:

a. The Contractor shall verify that the horizontal and vertical alignment is in compliance with WMATA, Airports Authority, and/or VDOT clearance standards. The Contractor may make minor adjustments to the rail alignments to refine the profile, achieve cost efficiencies, or avoid conflict with existing and future adjacent structures, provided that compliance with applicable criteria and standards are maintained.

b. The Contractor shall consider the effects of surcharge, live and/or dead loads when verifying the structural capacity of all existing structures and foundations affected by Package B. Structures determined to be overstressed under either temporary or permanent loading conditions shall be strengthened or protected from the influence of project loads.

c. The Contractor shall verify the adequacy of the subgrade to meet WMATA requirements. At-grade track shall be ballasted on concrete cross-ties, including locations of special trackwork.

d. Longer ties may be used in lieu of tie extenders for support of the contact rail.

e. Final track charts shall include the location of insulated joints, contact rail breaks, gaps and anchors, and indicate clearly which side of the track the contact rail is to be installed.

f. The Contractor shall design the rail lubricator system based on WMATA criteria and current practices. The type(s) and locations of lubricators shall be in accordance with the Project Technical Requirements.

g. The Contractor shall furnish and install security fencing along the perimeter of the Package B site in accordance with the Project Technical Requirements.

h. All structures subject to WMATA train loading shall be designed with Allowable Stress Method.

i. All underground structures shall be designed with Allowable Stress Method.

j. The Contractor shall develop a track system database for all Package B trackwork and supporting structures. The database shall consist of a single comma separated values (.csv) file using the most current version of Microsoft Excel that accurately tabulates all assets and their respective attributes within the track right-of-way. Each asset illustrated in the track charts shall contain its own worksheet tab within the consolidated .csv file and contain all necessary attribute data required to define the asset in terms of location (chain marker), track number (e.g. 1, 2 or 3), horizontal and vertical alignment, orientation, structure type and all other necessary descriptors in order to provide an accurate and complete database file which fully represents all asset and attribute data as shown in the track charts. Each asset shall have a unique asset identification number.

k. WMATA will provide a sample .csv file that shall be used by the Contractor during the design phase to begin creating the required track system database. WMATA's current database, which accurately represents its track charts for the existing system, contains approximately 40 (forty) separate worksheet tabs, each representing a specific asset along the track right-of-way. The Contractor shall submit a draft and final version of the track system database based on the as-built design. The draft submission shall be made 180 days prior to substantial completion in order for WMATA to review for compliance. The final submittal shall be made prior to Substantial Completion and include responses to all updated asset and attribute information.

2.4 RETAINING WALLS

2.4.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall design and construct all required retaining walls necessary to deliver a complete, safe, and operational rail yard for Package B.

All retaining walls shall be designed in accordance with the Project Technical Requirements and applicable criteria, codes, and standards based on site-specific soils parameters and backfill material requirements determined by the Contractor. The Contractor is responsible for coordinating the retaining wall design and construction with all other disciplines to ensure a fully integrated Package B.

2.4.2 ADDITIONAL RETAINING WALL REQUIREMENTS

The Contractor shall also comply with the following requirements when designing and constructing the retaining walls required for Package B:

a. Mechanically stabilized earth (MSE) wall, soldier pile walls and prefabricated modular gravity walls shall not be used to retain fills supporting the trackway.

b. Alternative wall systems, including Mechanically Stabilized Earth (MSE) walls and precast walls may be considered for applications other than the trackway provided that they comply with applicable criteria, codes and standards, including the requirements of the WMATA Design Criteria and are subject to WMATA approval.

c. The surface finish of cast-in-place walls, not exposed to public view, shall reflect the use of uncoated plywood formwork and a No. 1 Form Finish in accordance with the Project Technical Requirements. Cast-in-place walls exposed to public view require the use of APA HDO plywood for forms. If alternative wall systems are specified where precast elements are used, they shall also have a smooth finish unless otherwise noted.

d. The extent of retaining walls shown in Contract Drawings is preliminary. The Contractor is responsible for final grading and the proper sizing of the retaining walls.

2.5 ROADWAYS

2.5.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall design and construct all roadway elements in accordance with WMATA or VDOT and AASHTO requirements and other applicable criteria, and shall obtain all required reviews and approvals per the applicable jurisdiction's standard procedures and requirements. The Contractor is responsible for coordinating roadway design and construction with all other disciplines to ensure a fully integrated Package B.

The design and construction work for roadways on the Rail Yard site shall be performed in accordance with the WMATA Standards and Specifications. The Contractor must verify and use the latest version of the documents. The Contractor must meet or exceed the minimum roadway design standards and criteria.

The design and construction work for the Rail Yard perimeter access road on Airport property shall be performed in accordance with the MWAA Standards and Specifications. The Contractor must verify and use the latest version of the documents. The Contractor must meet or exceed the minimum roadway design standards and criteria.

The design and construction work for the Route 606 tie-ins and modifications shall be performed in accordance with the VDOT Standards, Specifications, Reference Manuals, Special Provisions and Supplemental Specifications Applicable to the Design and Construction of VDOT Facilities. The Contractor must verify and use the latest version of the documents. The Contractor must meet or exceed the minimum roadway design standards and criteria. If AASHTO or the MUTCD require that a higher or better standard be applied, then AASHTO and/or the MUTCD shall take precedence.

2.5.2 ADDITIONAL ROADWAY REQUIREMENTS

The Contractor shall also comply with the Project Technical Requirements and following requirements when designing and constructing the roadway elements in Package B. All roadways shall be design to enable access by WB-50 trucks.

2.5.2.1 MILLING AND RESURFACING OF MERCURE CIRCLE NORTHBOUND

The Contractor shall, in the last year of construction, mill and resurface all northbound lanes of Mercure Circle in accordance with Project Technical Requirements. The pavement shall be milled 1.5" and resurfaced with 1.5" Asphalt Concrete, Type SM-9.5D. If the traffic signal detector loops are damaged by the milling and resurfacing operation, the loop detectors shall be replaced by the Contractor.

2.5.2.2 ROADWAY SIGNAGE

The Contractor shall design and construct all new roadway signage required by Package B work on the VDOT roadways. The Contractor shall also relocate any existing signage affected or displaced due to the construction and operation of Package B. The Contractor shall design and construct all regulatory and wayfinding signs required for Package B.

2.5.2.3 ROADWAY LIGHTING

Where existing roadway lighting facilities are affected by the Package B activities, the Contractor shall install new lighting and/or relocate the lighting required to provide illumination in those areas. New lighting, if required, shall be approved, as applicable, by the Airports Authority or VDOT.

2.5.2.4 SWM FACILITY ACCESS ROADWAYS

The Contractor shall provide maintenance access roadways to all stormwater facilities constructed as part of Package B.

2.5.2.5 PAVEMENT REQUIREMENTS

Contractor shall prepare and incorporate the final design pavement sections into the plans, typical sections, profiles and cross-sections. Pavement sections shall be validated by analysis of projected traffic, analysis of soil conditions and pavement design calculations in accordance with the applicable Criteria, Codes and Standards noted in Section 1.6 of this Statement of Work. New or replacement pavement sections shall be designed and constructed by the Contractor in accordance with applicable criteria and standards. The Contractor shall incorporate under drains or edge drains into the pavement designs as required.

The Contractor shall be responsible for any temporary pavement design if needed for traffic control. Temporary pavement designs shall be designed in accordance with the AASHTO Guide for the Design of Pavement Structures (1993 Edition) and submitted to the Airports Authority for review. Temporary pavement designs developed using AASHTO shall have the following minimum design criteria. At a minimum, temporary pavement shall consist of 6 inches asphalt concrete and 6 inches of crushed aggregate. All temporary pavements shall be completely removed once it is no longer in service. The minimum design criteria for temporary pavement are as follows:

- Design Life – 6 months minimum
- Reliability – eighty percent (80%) minimum
- Initial Serviceability – 4.2 minimum
- Terminal Serviceability – 2.8 minimum
- Standard Deviation – 0.49 minimum
- CBR value for subgrade soils determined by laboratory tests

The minimum pavement sections require that proper grading be maintained to direct surface water away from paved areas and to provide for efficient runoff from surrounding areas. Control of both surface and ground water will be a very important consideration for the overall performance of these pavement designs.

2.5.2.6 TRAFFIC ANALYSES AND TRAFFIC CONTROL PLANS

The Contractor is responsible for development of a Transportation Management Plan in accordance with VDOT's Instructional and Informational Memorandum IIM-LD-241.5 for any temporary traffic control measures or work zone activities that affect Route 606. Additional information restrictions are noted in Division 1 Specification (01 14 00 Work Restrictions).

2.6 DRAINAGE AND STORMWATER MANAGEMENT

2.6.1 SUMMARY OF CONTRACT REQUIREMENTS

Package B includes site-specific stormwater management facilities. The Contractor shall design, furnish, and install all required drainage elements and stormwater management facilities in accordance with the Project Technical Requirements and applicable codes, standards, and criteria. The Contractor shall design all drainage elements in accordance with the applicable criteria (for both quality and quantity management of stormwater runoff) of the appropriate jurisdiction, shall obtain all standard approvals required by that jurisdiction, and construct these drainage elements and stormwater management facilities in accordance with these approvals. The Contractor is responsible for coordinating the drainage and stormwater design and construction with all other disciplines to ensure a fully integrated Package B.

The required drainage and conveyance systems include both open and closed systems. The Contractor shall provide a well-drained site and a safe environment in accordance with applicable design criteria. The design and construction of all roadway, site, guideway and drainage elements of Package B shall adequately address functionality, durability, ease of maintenance, maintenance access, safety, aesthetics, Best Management Practices and protection against vandalism.

For drainage, the overall scope of work shall include but not be limited to: grading, open and closed storm drain system design, spread calculations, hydraulic grade line calculations, inlet spacing, pipe sizing, adequate outfall, overland relief, and applicable stormwater management. In general, the track guideway drainage shall be accomplished by grading the sub ballast to track drains that connect to a closed drainage system.

For stormwater management, the Contractor shall develop all required design calculations, drainage area maps, hydrologic and hydraulic studies and plans necessary to obtain applicable regulatory approvals. The designs shall also address adequate outfall requirements.

During PE, an initial Phase 2 stormwater management design was completed as documented in the Project Reference Documents and the Preliminary Stormwater Management Report (September 2011). The Contractor shall note that the Package B PE design is based on the requirements stated in VDOT Instructional and Informational Memorandum (IIM) 195.6. Per agreement with VDEQ, Package B must comply with Part II-B of the current Virginia Stormwater Management Program regulations (9VAC870). The updated criteria may require larger or re-configured stormwater management facilities or alternative BMP types from those shown in the Package B PE design. The Contractor is responsible for designing drainage elements and stormwater management facilities in compliance with the applicable VDEQ requirements.

All stormwater management and BMP facilities are required to have maintenance access roads per applicable criteria, codes or standards and as noted in the Project Technical Requirements.

2.6.2 ADDITIONAL DRAINAGE AND STORMWATER MANAGEMENT REQUIREMENTS

The Contractor shall also comply with the following requirements when designing and constructing the drainage elements and stormwater management facilities in Package B:

a. Designs that allow the short-circuiting of flow between the inflow and outflow points for SWM ponds will not be accepted. Appropriate measures shall be installed such as baffles to lengthen the flow path as required to meet the design guidelines. The SWM pond bottom shall be graded in order to allow for positive flow to the outfall structure per the design criteria. The Contractor is required to perform field-surveys and analysis of adequate outfall channels as per the applicable codes, standards, or guidelines provided by the local jurisdictions, whichever are deemed to be more stringent.

b. The Contractor shall provide dam breach analyses to verify the safety of all SWM pond embankments.

c. Alternative materials (other than corrugated metal pipe) that meet both permitting and end-user maintenance requirements for underground stormwater management facilities may be used.

2.6.2.1 STORM DRAIN SYSTEMS

Runoff within the limits of Package B, and off-site storm water draining into the Package B boundaries, shall be collected and conveyed to a proposed storm drain system. The storm drain design shall honor the natural divides, and it shall address the 100-year storm event overland relief requirements.

Existing drainage pipes and culverts proposed to remain in place shall be evaluated for hydraulic capacity and structural integrity. If necessary, these facilities shall be adequately cleaned, repaired, or replaced to ensure their designed hydraulic conveyance performance. The Contractor shall refer to the Project Technical Requirements for condition inspection, restoration, maintenance, and cleaning of existing drainage requirements.

2.6.2.2 INLETS, CATCH BASINS AND PIPES

Any inlet, pipe, or storm drain structure that will not become part of the final drainage system shall be removed.

2.6.2.3 CONNECTIONS TO EXISTING SYSTEMS

The Contractor shall design and construct necessary connections with existing storm drain systems. The existing drainage patterns shall not be impeded in any way that would impact the safety of the traveling public during the construction of Package B.

2.6.2.4 ROADWAY UNDER DRAINS

Existing roadway under drains are not shown in the PE design. The Contractor shall maintain any under drains and under drain outfalls during construction activities and replace in-kind any

under drains and under drain outfalls disturbed or damaged by the Work. The Contractor shall design and construct new under drains and under drain outfalls for new and/or reconstructed roadways where required by WMATA, Airports Authority and/or VDOT criteria.

2.6.2.5 FLOODPLAINS

Per the Record of Decision for the Project, Package B shall not increase 100-year flood elevations by more than one foot. The Contractor shall perform all required hydrologic and hydraulic studies necessary to evaluate any effects of the Package B design on the 100-year floodplain and 100-year water surface elevations. If necessary, the Contractor shall obtain approvals from the appropriate jurisdiction for any increases in the 100-year flood elevation, if required, and shall obtain FEMA approval for Flood Insurance Rate Map Revisions. .

2.6.2.6 EROSION AND SEDIMENT CONTROL

The Contractor shall prepare all designs and erosion and sediment control plans depicting the construction entrances, disturbed areas, and laydown areas for materials and equipment necessary to obtain erosion and sediment control permits for construction of Package B.

2.6.2.7 SWM REQUIREMENTS FOR LOCAL ROADWAYS

Stormwater management and BMP facilities for local roadway improvements included in the scope of Package B are not depicted in the PE design. The Contractor shall comply with VDOT drainage and stormwater management requirements at these locations, including upgrades to stormwater management facilities if existing facilities are determined to be inadequate.

2.7 UTILITIES

2.7.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall be responsible for the design and construction of all utilities and utility relocations necessary to accommodate and deliver Package B in accordance with the Project Technical Requirements and applicable criteria, codes, and standards. The work includes performing all investigations necessary to verify the type, location and depth of all existing utilities within the limits of the Contractor's activities. The Contractor is responsible for coordinating and integrating utilities design and construction with all other disciplines to ensure a fully integrated Package B.

The Contractor is responsible for verifying the location of existing utilities prior to construction, in accordance with applicable laws, regulations, ordinances and utility company requirements

The Contractor shall determine any utility construction conflicts and compliance issues, which require the utility to be relocated or adjusted. All existing utilities that are affected by the construction of Package B either by direct physical conflict or by proximity such that they no longer meet criteria shall be relocated or protected in place by the Contractor. Utility relocation and protection shall be performed in such a manner that brings the impacted utilities in compliance with applicable criteria. Relevant criteria include, but are not limited to, horizontal and vertical clearance requirements, loading, and maintenance access. The Contractor shall support and protect existing utilities during construction in accordance with the Project Technical Requirements.

The Contractor shall communicate and coordinate with the utility owners, including holding coordination meetings, preparing sketches, and analyzing as-built design information to resolve any construction conflicts. The Contractor shall also resolve compliance issues such as applicable easements, maintenance access and agreements. The Contractor shall review relocation plans produced by the utility owners and coordinate relocation with the utility owners.

All underground utilities, existing, new and relocated, that will cross the proposed track, roadways, and facilities to be maintained and operated by WMATA shall be identified using WMATA standard utility markings and/or any marking standards required by the utility owner.

2.7.2 ADDITIONAL UTILITIES REQUIREMENTS

The Contractor shall also comply with the following requirements when designing and constructing the utilities and utility relocations in Package B.

a. Utility Profiles. Preliminary profiles of proposed water and sanitary sewer lines have been developed. Elevations of the existing lines crossing these lines and at existing connection points shall be verified by the Contractor.

b. Pipeline and Conduit Crossings. All pipeline and conduit crossing beneath at-grade embankment and track sections shall be protected in place in accordance with applicable provisions of the WMATA criteria.

c. Stray Current. Where Package B facilities are to be within the vicinity of metallic pipelines, the Contractor shall evaluate and identify any risks to these pipelines from corrosion by stray current.

2.7.2.1 COORDINATION WITH UTILITY OWNERS

a. Loudoun Water. The Contractor shall coordinate with Loudoun Water on an acceptable point of connection for the proposed sanitary line from the Package B facilities receiving water service. At any building receiving water service, fire and domestic water service shall be independent connections to Loudoun Water's main. For the design of all crossings and connections, the Contractor shall obtain the appropriate permits and easements and comply with Loudoun Water's design requirements, including its Engineering Design Manual. The Contractor shall also coordinate with Loudoun Water regarding its Broad Run Interceptor - Parallel Potomac Interceptor project.

b. Loudoun Water may require a flow monitoring system (sewer meter) to be installed prior to connecting to their sewer systems. The Contractor shall be responsible for resolving the sewer connection requirements and for obtaining the connection permits to the existing sanitary sewer system.

c. Columbia Gas. The Contractor shall coordinate with Columbia Gas to determine the exact location of the existing gas line along Route 606 approximately 4000 LF to the southwest of the project site. The Contractor shall perform a load analysis for the proposed buildings to determine if the existing Columbia Gas line can properly handle the loads required prior to connection.

2.7.2.2 COORDINATION WITH VDOT ROUTE 606 RECONSTRUCTION PROJECT

Contractor shall coordinate with the VDOT Route 606 Reconstruction Project to determine the proposed location of any utilities along Route 606 that are needed to complete Package B.

2.7.2.3 STRUCTURAL ANALYSIS

The Contractor shall comply with the requirements for minimum cover over utilities and drainage structures. The Contractor shall perform a structural evaluation of all existing and new drainage structures, pipes, utilities, and box culverts that may be affected by the construction of the track, stormwater management facilities, or traction power ductbank. The evaluation shall consider the influence of all loading applied including any new surcharge from the track structures. Analyses shall be done using the AASHTO Standard Specification for Highway Bridges or other approved methodology. Any existing drainage structure, culvert or pipe which is insufficient to support the proposed loading shall either be replaced or protected in place with a properly designed structure, pipe or culvert.

SECTION 3. FACILITIES

3.1 BUILDINGS

3.1.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall be responsible for the design, construction, and delivery of the following buildings and other facilities included in Package B in accordance with the Project Technical Requirements and applicable Criteria, Codes, and Standards: Service and Inspection (S&I) Maintenance Building, Warehouse, Maintenance of Way (MOW) Building, the Transportation/Police Building, the Train Wash Building, the Vehicle Storage Building, two TPSS Buildings, three TCR Buildings, a Gate House, a boarding platform, car service platforms, storage bins and a salt dome. The entire Rail Yard and Maintenance Facility shall be designed to support maintenance operations on revenue vehicles. The buildings shall be designed to facilitate scheduled inspections, minor repairs, car cleaning, truck repair and replacement, and minor painting. The shop systems will provide for segregation of work functions into designated areas as shown to minimize interference between functions and time lost in material or equipment handling evolutions. The Contractor shall be responsible for all required signage.

The design included in the Project Technical Requirements reflects the conceptual design and minimum requirements of the Work. The Contractor is responsible for coordinating and integrating utilities design and construction with all other disciplines to ensure a fully integrated Package B.

3.1.2 ADDITIONAL REQUIREMENTS FOR BUILDINGS

The Contractor shall also comply with the following requirements when designing and constructing the buildings included in Package B:

a. Design and layout of all rooms and functional spaces shall conform to the Project Technical Requirements. The room locations as shown are prescribed by the standards and room areas as listed are minimum and approximate. The Contractor shall further refine the room dimensions and locations by coordination of functional relationships, compliance with all applicable codes and ADA requirements, equipment requirements (including vertical and horizontal clearance requirements), as well as user and maintenance requirements to ensure a proper and functional design.

b. The Contractor shall employ experienced architects and engineers with proven design experience on similar facilities. The Airports Authority and WMATA have a history of and an expectation for architectural design excellence for all its facilities both public and non-public. The Contractor shall develop safe, functionally economical as well as aesthetically attractive buildings. Consideration shall be given to creative uses of materials, massing, scale, form, texture, and detailing. Buildings shall be visually attractive, innovative, as well as functional and durable. The overall architecture should impart a sense of pride within the local community, and provide a stimulating and attractive environment for the people who will see, work in, and use the buildings on a daily basis.

c. The Contractor is to include in the design all reasonable provisions for the orderly and planned extension of facilities as shown with a minimum of disruption to the operating facility.

d. The areas shown on the Contract Drawings represent the minimum spatial requirements and minimum nominal square foot areas of usable floor space. The Contractor is responsible for increasing any given area as required to meet the final design requirements to accommodate circulation, wall thicknesses, structure, mechanical, electrical, and plumbing, systems, equipment and furnishings. Design and layout of all rooms and functional spaces shall conform to the reference standards, drawings, and criteria.

e. Provide doors and partitions with consideration to use and space utilization. Materials, room finishes and doors shall be provided as indicated. Provide doors and partitions with UL fire rating required by local codes. Provide door numbering system in a door schedule to coordinate with the room numbering system.

f. Provide signage for each room at each door. Provide building identification signs, site entrance monument sign, track number signs for MOW and Maintenance buildings, and additional signage as required, with location and lettering coordinated with the Airports Authority and in conformance with WMATA Signage Graphic Standards. Coordinate exterior signage, traffic control signs, and directional signage with track work and existing exterior signs.

g. To conform to area constraints at the site, the car maintenance shops and other buildings shall maintain both the clear interior and exterior building shell limits illustrated in the Contract Drawings for the placement and movement of equipment, vehicles and personnel. The interior clearances illustrate the limits of clear floor area devoid of exterior walls, partitions and structural elements and the vertical clearances are to bottom of roof structure.

h. All mechanical and electrical rooms shall be sized per the specific needs of the Contractor's final design with due consideration for maintenance of equipment within those rooms.

3.2 BASIS OF BUILDING DESIGN

3.2.1 LEED AND SUSTAINABLE DESIGN

Package B shall be designed and constructed in a sustainable manner. The Airports Authority has designated three buildings for LEED Certification. These are the S&I Building, the MOW Building, and the Transportation/Police Building. The Contractor shall:

a. Design, construct, and commission the designated buildings as required to obtain LEED Silver Certification as established by the US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) for New Construction, 2009;

b. Provide all LEED-accredited personnel required to design, construct and commission each facility. At a minimum, LEED-accredited personnel shall include a LEED Accredited Professional (AP) on the Contractor's staff, and one from each designer's staff. One of the LEED APs shall be designated "LEED Project Administrator" and be responsible for coordination and documentation of all LEED/USGBC requirements. The LEED Project Administrator shall be responsible for conducting meetings with the stakeholders to coordinate the development and approval of the list of LEED credits necessary for LEED silver certification.

c. Perform all LEED planning and analysis Work for each building. Using the Integrated Design Strategy, the design team shall determine goals for integrating means and methods to reduce energy consumption, reduce demolition and construction waste, and use as many environmentally friendly materials as possible into the final design. The assessment shall be documented using the LEED Checklist. The Checklist will establish which sustainable building methods will be utilized and set point goals within the USGBC Rating System;

d. Prepare and submit to USGBC all application and documentation materials required to obtain the USGBC/LEED certification for the facilities, and coordinate all related communications with USGBC. Each building is to be a separate LEED application;

e. Register all structures seeking LEED certification with USGBC prior to the registration sunset date established by the U.S. Green Building Council for LEED 2009. Achieve final certification prior to the certification sunset date for LEED 2009. Otherwise, the Contractor shall be responsible for meeting the requirements for Silver certification under LEED v4.

f. Pay all USGBC fees necessary to obtain certification for each LEED-designated facility;

g. Provide framed certificates and mounted glass wall plaques from the USGBC.

3.2.2 COORDINATION WITH WMATA OPEN OFFICE PLANS

Provisions for lighting, power, communications, and data systems in the designated open office spaces reserved for the administrative office functions, shall be coordinated with future space plans developed by WMATA. The WMATA-furnished designs will include floor plans and space program for conference rooms, storage rooms, and open office workspaces with systems furniture and demountable partitions. Except as noted below, construction of these spaces is not part of the Contractor's scope.

In these designated areas the Contractor shall:

- Incorporate the WMATA-furnished space plan in the construction documents;
- Include WMATA deliverables in his project schedule;
- Provide demising partitions shown on the Contract Drawings;
- Provide conduit and ceiling-mounted junction boxes for electrical service to the WMATA offices. The junction boxes shall be provided at a rate of not less than one per 500 square feet of open office area.
- Provide plumbing connections for a sink and dishwasher at each of two locations within each open office area.

3.2.3 CODE ANALYSIS

The Contractor shall be responsible for performing a Code Analysis that defines the construction type, means of egress, and required fire protection based on its final design.

a. S&I, MOW, Warehouse, and Train Wash Buildings. These are considered as portions of one building on the same lot per VCC 503.1.2, and the building height of each building and the aggregate building area of the buildings are designed to be within the limitations of VCC Table 503 as modified by VCC Sections 504, 506 and 507, in order to qualify as one "combined building." Therefore, the fire-resistance ratings and maximum openings based on fire separation distances, and the fire protection ratings of opening protectives, all as stipulated in VCC Tables 602, 705.8, 715.4 and 715.5, do *not* apply to the walls between these buildings. The requirement for at least 60 feet open space around the entire perimeter of these buildings in order to qualify for Unlimited Area per VCC 507.3 and 507.4, applies to the space around the one "combined building" and not to the spaces between these buildings.

b. S&I and MOW Buildings. Building height and area limitations: Based on use (F-1 Factory Industrial and Business), size and configuration of the S&I, MOW buildings and future Heavy Damage building (a two-story structure), the buildings are classified and designed to comply with requirements for "Unlimited Area Buildings" per VCC, Section 507.4, with Type IIB unprotected non-combustible construction. The structures shall be no more than two stories above grade plane, fully sprinklered and have at least 60 feet open space around their portions of the outside perimeter of the "combined building" to qualify for Unlimited Area.

c. Warehouse Building. Building height and area limitations: Based on use (S-1 Storage), size and configuration of the Warehouse Building, (one-story structure with a mezzanine), the building is classified and designed to comply with requirements for "Unlimited Area Buildings" per VCC Section 507.3. The Construction Classification is Type IIB unprotected non-combustible construction. The one-story structure shall be fully sprinklered and have at least 60 feet open space around their portions of the outside perimeter of the "combined building" to qualify for "Unlimited Area".

d. Train Wash Building. Building height and area limitations: Based on use (F-1 Factory), size and configuration of the Train Wash Building, the building is classified and designed to comply with requirements for "Unlimited Area Buildings" per VCC Section 507.3,. The Construction Classification shall be Type IIB unprotected non-combustible construction. The one-story structure shall be fully sprinklered and have at least 60 feet open space around its portion of the outside perimeter of the "combined building" to qualify for Unlimited Area.

e. TPSS, TCR and Vehicle Storage Buildings. Building height and area limitations: Based on use (U Utility), size and configuration of the TPSS, TCR, and Vehicle Storage buildings, the buildings are classified and designed to a maximum 8,500 square feet per VCC Table 503. All three buildings have a Construction Classification of Type IIB unprotected non-combustible construction and are not required to be sprinklered.

   The TPSS, TCR, and Vehicle Storage buildings shall maintain a fire separation distance of at least 10 feet open space around the entire perimeter of each building per VCC table 602.

f. Transportation/Police Building. Building height and area limitations: Based on use (B – Business), size and configuration of the Transportation/Police Facility building, the building is classified and designed to maximum 23,000 square feet per VCC Table 503. The Construction Classification is Type IIB unprotected non-combustible construction. The two-story structure shall be sprinklered. The Police Facility shall maintain a fire separation distance of at least 10 feet open space around the entire perimeter of the building per VCC Table 602.

3.3 BUILDING MATERIALS

The exterior construction shall be consistent for all of the buildings comprising insulated architectural precast panels on the lower part of the wall for durability changing to either a:

- Prefinished insulated metal panel system above, as shown in the Project Technical Requirements, or
- Insulated architectural precast panels with external joint and reveal locations as shown in the Project Technical Requirements.

a. The top of the exterior wall shall be capped with a pre-formed aluminum coping and parapet running continuously at the top of the wall. The Train Wash Building due to constant subjection to water and moisture is to have full height architectural insulated precast exterior walls. Minimum insulating value of exterior walls is based on the requirements needed to meet LEED Silver Certification while simultaneously satisfying all local codes, regulations and ordinance requirements including the International Energy and Conservation Code.

b. The structural system shall be wide-flanged steel beams and columns with steel bar-joists and steel metal roof deck. The roofing system shall be heavy duty membrane roofing over protection board and rigid insulation secured to the metal roof deck. The roof over the maintenance area shall include clerestories that will bring natural lighting into the work area. Smoke relief vents and internal roof drains spaced throughout the roof area shall be provided.

c. The interior partitions of the repair shop and inspection areas shall be reinforced concrete unit masonry construction and concrete floor slabs with epoxy paint finish. The interior partitioning of office areas shall be gypsum board on metal stud framing. The flooring in the office areas shall be a combination of vinyl tile and carpeting based on use.

d. The Gate House shall be a factory-assembled unit with all accessories, islands, power, conduits, plumbing, heating and ventilation, furniture and equipment, as specified herein and in locations and quantities as shown on the Contract Drawings. The Gate House shall be fully accessible to disabled persons.

e. The TPSS/TCR buildings shall be prefabricated units composed of insulated metal wall panels.

f. The Salt Dome shall be prefabricated timber construction with dimensions in accordance with the Project Technical Requirements.

3.3.1 EXTERIOR ENCLOSURES

The Contractor shall provide weather resistant, protective, insulating, durable, impact resistant exterior walls windows, doors, and roofing in accordance with the Project Technical requirements and the following subsections.

3.3.1.1 EXTERIOR WALLS

a. Exterior Skin shall be cast-in-place concrete, precast concrete, insulated metal panels.

b. Expansion and Shrinkage Control. The Contractor shall provide elastomeric joint sealants at concrete and precast concrete, preformed gaskets at insulated metal wall panels. Provide integral water repellants at concrete walls. Joint sealants shall be provided at expansion and control joints, perimeter of window, door and louver openings, joints between different materials, and all joints essential to close building to the weather.

c. Exterior wall construction shall be designed using “Rain Barrier” principle. Provide single layer for water barrier, vapor barrier, and provide a minimum of R-19 thermal insulation. Provide all required flashing and copings.

d. Vapor Retarders, Air Barriers, and Insulation.

- Provide continuous vapor barrier on the warm-in-winter side of the thermal insulation.
- Provide continuous air barrier including foundation exterior walls, and roof; insure sealed transitions at foundation/wall, wall/wall penetration, and wall/roof interfaces.
- Provide closed cell extruded polystyrene board insulation for insulated precast wall panels.
- Provide polyurethane foam insulation for insulated metal panels.

e. Exterior Wall Interior Skin.

- Exposed concrete surfaces shall be coated with paint or high performance coatings as required by surrounding use.
- Exposed Architectural Precast Concrete surfaces shall be in accordance with the Technical Specifications for surface, color and finish.

f. Parapets. Use same construction as Exterior Walls

g. Exterior Louvers, Grilles and Screens.

- Exterior louvers shall to be coordinated with the insulated metal wall panels.
- Solar shades shall be coordinated with the exterior wall construction.

h. Exterior Soffits. Canopies at exterior doors shall be painted galvanized steel.

3.3.1.2 EXTERIOR WINDOWS

a. Exterior Standard Windows. Exterior windows shall have extruded aluminum framing, not less than AW40 performance class and grade per AAMA/WDMA 101.I.S.2/NAFS, with low-e insulating glass.

b. Glazed Curtain Wall.

- Provide glazed curtain walls fabricated from extruded aluminum and glass and opaque panels for exterior use as noted below.
- Provide a thermal break system appropriate for controlled climate building applications
- Provide High Performance Organic Coating with a minimum 20-year finish warranty.

3.3.1.3 EXTERIOR DOORS

The Contractor shall provide exterior doors that are durable, operate smoothly and easily without extraneous noise, do not make noise or vibrate under wind, thermal, or operational movements, are weather resistant, keep out the elements of wind, rain, and snow, and do not harbor insects and rodents. A high security heavy duty key box shall be provided on each building for fire department access.

a. Exterior Entrance Doors.

- Aluminum Framed Entrance Doors: Provide doors fabricated of extruded aluminum and fully tempered or laminated safety glass with heavy duty hardware.
- Provide wide stile doors with 10 inch bottom rail.
- Meet physical and testing requirements outlined in the Technical Specifications.
- Provide finish equivalent to High Performance Organic Coating with a minimum 20-year finish warranty.
- Hollow Metal Entrance Doors: Provide doors fabricated of formed sheet steel with heavy duty hardware in accordance with the Technical Specifications.

b. Exterior Utility Doors.

- Provide doors fabricated in accordance with the Technical Specifications and with sound deadening, insulated core, with smooth surfaces without visible seams or joints on exposed surfaces with heavy duty hardware.
- Provide hollow metal frames of the same sheet steel as doors, with corner joints mitered and faces continuously welded and finished smooth.

c. Large Exterior Special Doors.

- Provide insulated, overhead coiling doors for train entry and exit at maintenance bays, cleaning bays, service bays, and storage bays, fabricated of formed sheet steel with heavy duty hardware in accordance with the Technical Specifications.

- Operation: Provide electric operation triggered by push button station on interior of building and exterior detector to close door after train leaves the building. Include self-monitoring obstruction detection monitoring device.
- Provide door sizes detailed in the Door Schedules and as required.

3.3.1.4 ROOF COVERINGS

The Contractor shall provide weather resistant, leak-proof, energy efficient, durable, roof coverings that do not overload support structure. All roofing system warranties shall cover all components in the roof assembly regardless of whether the components are products of a single roofing manufacturer.

Roof flashing installation shall allow for repair and maintenance of roofing system without disturbing or impacting warranty and water–tightness of parapets, copings, curbs, or exterior wall system.

a. Deck Vapor Retarder and Insulation.

- Provide vapor retarder under insulation over all areas generating heat and moisture, such as steam cleaning and vehicle wash areas. Provide vapor retarder over other areas recommended by the roofing membrane manufacturer. Install over fire resistant substrate board.
- Provide roof insulation and cover board under roof covering sufficient to meet local energy code requirements, minimum R value of 20. Provide roof insulation acceptable to roof membrane manufacturer.
- Provide continuous air barrier for roof and tie into exterior wall air barrier system.\

b. Membrane Roofing.

- Provide manufacturer's standard elastomeric membrane roofing consisting of fully-adhered EPDM roofing membranes..
- Provide manufacturer's 20-year system warranty, without monetary limit, on complete roofing system including flashings, insulation, vapor retarder, air barrier, roof membrane, and roof accessories.

c. Flashing and Sheet Metal. Provide field and shop formed sheet metal flashings and accessories for roofs and elsewhere as required, such as counter flashings, expansion joint covers, splash pans, penetration flashings, and other similar items.

d. Building Expansion Joint Covers. Provide wall-roof or roof-roof expansion joint covers at building expansion joints.

e. Roof Specialties and Accessories.

- Manufactured Roof Specialties: Provide manufactured copings, roof edge flashings, and drainage components as required, fabricated of metal matching other metal roofing components. Provide smooth, straight, components without oil-canning and with uniform color and finish.

- Provide manufactured curbs, ventilators, or other accessories as required.

3.3.1.5 ROOF OPENINGS

The Contractor shall provide clerestories, hatches and vents shall be curb-mounted to allow for repairs and maintenance without disturbing roof membrane and associated flashings.

f. Clerestories. Provide clerestory elements that consist of a steel structure, fixed aluminum windows, and a roof similar to other building roofs.

g. Hatches and Vents. Provide roof access hatches as needed to provide access to roofs. Hatches shall be of durable construction with insulated curb, ladder, safety post and factory paint finish. Provide hatch type smoke relief vents as required by codes and the regulations connected to building fire and smoke alarm systems, of durable construction with factory paint finish.

3.3.2 INTERIOR CONSTRUCTION

3.3.2.1 INTERIOR PARTITIONS

The Contractor shall provide durable partitions that are appropriate and proven-in-use for the activities and locations for which they are installed.

a. Interior Fixed Partitions. Provide interior fixed partitions which extend to the structural deck above, unless otherwise indicated.

- Unit Masonry Partitions: Provide at interior maintenance, service, shop, parts, and cleaning areas and other areas subject to impact, abrasion, moisture or soiling.
- Framed Assemblies: Provide as appropriate in office and employee areas. Provide steel framed assemblies, with corrosion resistant steel studs in 20 gauge thicknesses as a minimum.
- Wire Mesh Partitions: Where required, provide heavy duty wire mesh partitions with steel wire and woven into square or diamond mesh pattern in accordance with the Technical Specifications. Provide doors, service windows, top cap, bracing, and accessories as required.
- Provide shop applied baked enamel or powder coat finish.

b. Interior Railings. Provide painted steel interior handrails, guardrails, at stairways, edges of mezzanines, and other locations required by the building code. Galvanize railings in pits and/or in areas subject to wet conditions.

c. Interior Windows (Borrow Lites). Provide interior windows between work areas as required for control and security of operations, to enhance day-lighting from exterior windows.

d. Operable Partitions. Provide manually-operated, individual single panel partitions with a minimum STC rating of 50, with panel construction as follows:

- Nominal 3 inch (76 mm) thick in manufacturer's standard 48 inch width by height required;
- Horizontal and vertical framing elements fabricated from 18 gage formed steel with overlapped and welded corners;
- Reinforced top channel to support suspension system components;
- Frame with concealed formed steel at vertical edges.

3.3.2.2 INTERIOR DOORS

The Contractor shall provide interior doors that are durable, operate smoothly and easily without extraneous noise. The Contractor should avoid door thresholds in maintenance and shop areas unless necessary. If necessary, thresholds shall be industrial grade in these areas. All doors shall have STC ratings equivalent to specified Room STC ratings.

a. Provide Medeco-compatible locking hardware for all SMNT room doors and Corbin-Russwin compatible locking hardware for all other (PLNT) doors. MTPD facilities on the 2nd floor of Transportation and Police Building shall have access control with card readers at stairs and elevator. The MTPD facilities shall be High Security Areas as defined in the Project Technical Requirements. These designated areas shall be equipped with an Intelligent Combination Keypad/Proximity Card Reader device for Intrusion Alarm By-Pass activation.

b. Interior Swinging Doors.

- Provide interior swinging doors to facilitate the passage of personnel and materials between rooms and provide privacy and security for rooms. Provide hollow metal doors and frames, with grouted frames in maintenance and utility areas and wood doors with hollow metal frames in office and employee amenity areas.
- Hollow metal doors and frames in damp or wet environments (toilets, janitorial closets, break rooms, etc.) shall be hot-dipped galvanized.
- Hollow metal doors and frames shall be steel with fully welded seamless construction.
- Provide heavy duty operating hardware including protective kick plates at doors with closers.

c. Interior Entrance Doors.

- Provide interior entrance doors to provide secure access to reception areas and departmental areas. Provide doors and frames of glazed aluminum storefront type.
- Provide wide stile interior entrance doors and frames that match main building entrance doors and frames.
- Provide heavy duty operating hardware, with 10 inch bottom rail.

d. Interior Coiling Doors.

- Provide interior coiling steel doors where required for access in interior maintenance area or where required to act as a fire shutter to protect fire rated interior openings.
- Provide electric operation and viscous governors for full size service doors designed for vehicle passage or larger than 80 square feet in area.
- Interior coiling doors less than 80 square feet shall be manual chain hoist operation.

e. Access Doors and Panels.

- Provide where required for access to mechanical and electrical services, fabricated of steel, shop painted, with keyed locking.
- Provide access doors and panels with insulation, fire ratings and STC ratings as required to maintain thermal, fire or sound rating of adjoining construction.

3.3.2.3 INTERIOR FITTINGS

The Contractor shall provide durable interior fittings suitable for the purpose intended. Provide smooth, easy operation for operable fittings Interior fittings in accordance with the Project Technical Requirements and the following subsections.

a. Wall and Corner Guards. Provide wall and corner guards in maintenance and service areas.

b. Fabricated Toilet Compartments. Provide toilet compartments in group toilet rooms. Include urinal screens in group men's toilet rooms.

c. Interior Signs and Identifying Devices. Provide directories and interior signage to identify and locate departments, rooms, and areas. Provide identification signage on each room with room number and room/occupant name easily changeable. Provide special equipment to fabricate room names and numbers. Provide identifying, safety, and directional signage at maintenance and service bays. Comply with accessibility code for sign placement.

d. Lockers. Provide metal lockers in locker rooms and locker area. Provide single tier, full height wardrobe lockers of all welded construction, with ventilation louvers and hasp for locking by padlock by others. Include hat shelf, clothes hooks and hanging rod as is standard with manufacturer. Provide finished ends, filler panels, sloping tops, and continuous metal bases. Provide accessible lockers at each area per accessibility code.

e. Toilet and Bath Accessories. Provide toilet and bath accessories fabricated from stainless steel. Provide paper towel dispensers, waste receptacles, toilet tissue dispensers, soap dispensers, grab bars, sanitary napkin disposal units, shower curtains, hand dryers, mirrors, and clothes hooks as required for convenient and efficient use of toilet and bath facilities. Provide and locate accessible toilet and bath accessories

including shower seat per accessibility code. Provide mop and broom holder with shelf in janitor's closets.

f. Countertops. Countertops, back and side splashes shall be fabricated from a solid surface material.

3.3.3 STAIR AND LADDER CONSTRUCTION

3.3.3.1 INTERIOR STAIR CONSTRUCTION

The Contractor shall provide durable, structurally sound stair and ladder construction in accordance with code and free from movement and vibration when loads are applied.

a. Stairs. Provide metal stairs fabricated of steel channel or tube stringers, headers, and platform framing and sheet steel metal pans treads filled with reinforced concrete. Construction shall be all welded without bolts or rivets.

b. Ladders. Provide metal ladders where required for access to roof areas and elevator pits. Construct ladders of steel flat plate or extruded aluminum side rails and round steel bar rungs with integral non-slip surface. Galvanize exterior ladders and interior ladders subject to wet conditions.

3.3.3.2 INTERIOR STAIR FINISHES

The Contractor shall finish interior stairs in accordance with the Project Technical Requirements and the following subsections.

a. Stair Tread, Riser and Landing Finish. Provide stair treads and landings with non-slip decorative finish of pre-formed resilient rubber, resinous flooring, colored dry shake hardener, or equivalent. Galvanize interior stairs subject to wet conditions. Plain or painted concrete, vinyl, or abrasive-coated treads and landings are not acceptable.

b. Stair Painting. Paint all exposed metal portions of stair construction and railings with heavy duty durable enamel paint.

3.3.4 INTERIOR FINISHES

3.3.4.1 INTERIOR WALL FINISHES

The Contractor shall provide durable interior wall finishes designed to withstand heavy use with abrasion and moisture resistance appropriate for specific use. Refer to the Room Finish Schedules in Contract Drawings for specific requirements.

a. Gypsum Board Wall Finishes. Provide gypsum board wall finishes where indicated, minimum 5/8 inch thickness. Provide moisture and mold resistant gypsum board in humid areas such as locker rooms. Provide tile and tile backing panels where exposed in wet areas such as showers. Tile backing panels in wet areas shall be cementitious

backer units. Comply with requirements for fire rated construction. Finish exposed gypsum board in Level 4 finish as a minimum, with Level 5 finish required for higher finish areas such as meeting rooms, executive offices, and reception lobbies.

b. Tile Wall Finishes. Provide tile wall finishes where indicated on the Contract Drawings and a in accordance with the Project Technical Requirements. Provide durable and easily cleanable tile finishes. Install wall tile with liquid latex modified Portland cement mortar and grout.

c. Sound Attenuation. Provide sound attenuation insulation in gypsum board partitions where indicated and in accordance with the Project Technical Requirements. Provide acoustical sealant at the perimeter of partitions requiring a sound rating.

d. Interior Wall Painting. Provide paint or high performance coating finish on various interior wall surfaces in accordance with the Project Technical Requirements. Provide premium quality paint or high performance coatings with VOC content below code and LEED limits as applicable. Provide semi-gloss enamel paint in wet areas. Provide flat wall paint in higher level finish areas such as meeting rooms, executive offices, and reception lobbies. Provide satin or eggshell finish enamel paint in all other locations. Provide high performance coatings with semi-gloss finish on all wall surfaces in rooms indicated, except offices, training rooms, and dry employee locker and lunch rooms may be eggshell or satin finish.

3.3.4.2 INTERIOR FLOOR FINISHES

The Contractor shall provide durable interior floor finishes designed to withstand heavy use with abrasion and moisture resistance appropriate for specific use for purpose indicated. Refer to the Room Finish Schedules in the Contract Drawings for specific requirements.

a. Concrete Floor Finishes. Provide sealer/hardener finishes for concrete floors where indicated. Sealer/hardener in maintenance areas and service lanes shall be integral non-metallic hardener with integral light reflective color that hardens and densifies concrete surfaces, making them cleanable and resistant to oils and liquid penetration and staining, and is recommended by the sealer/hardener manufacturer for the application indicated. Provide slip resistant finish.

b. Tile Floor Finishes. Provide tile and paver finishes where indicated in accordance with the Project Technical Requirements. Provide slip resistance in accordance with accessibility requirements and as required in wet areas. Install floor tile with mortar and grout Include waterproofing membranes and crack suppression membranes at tile floors.

c. Resilient Flooring.

- Provide vinyl composition tile flooring in storage and utility rooms as indicated on the Room Finish Schedules..
- Provide Type TS vulcanized, thermoset rubber wall base as indicated on the Room Finish Schedules.

d. Carpet Flooring. Provide carpet flooring where indicated on the Room Finish Schedules. Carpet backing and adhesive shall contain a minimum 20% recycled material and comply with CRI "Green Label" and LEED VOC requirements.

e. Resinous Flooring. Provide epoxy resin terrazzo resinous flooring in spaces identified in the Room Finish Schedules.

3.3.4.3 INTERIOR CEILING FINISHES

The Contractor shall provide interior ceiling finishes appropriate for specific use for purpose indicated. Refer to the Room Finish Schedules in the Contract Drawings for specific requirements.

a. Gypsum Board Ceiling Finishes. Provide gypsum board ceilings where indicated in the Project Technical Requirements. Gypsum board at ceilings shall be a minimum of 5/8 inches thick. Provide moisture and mold resistant gypsum board where exposed to wet areas such as showers. Comply with requirements for fire-rated construction. Finish gypsum board ceilings to a minimum Level 4 finish.

b. Acoustical Ceiling Treatment. Provide acoustical panel ceilings where indicated in the Project Technical Requirements. Provide heavy duty painted steel suspension system or equivalent. In the maintenance bays and shop areas, provide acoustical sound baffles in the joist space.

c. Interior Ceiling Painting. Provide paint finish for gypsum board ceilings and soffits and high performance coatings for exposed structural elements in maintenance and service areas. Provide premium quality paints and high performance coatings with VOC content well below maximum levels allowed by codes and regulations, including LEED requirements, and as low as possible from manufacturer's available selection for both types of coating. Provide semi-gloss enamel paint in wet areas such as shower rooms, flat ceiling paint on gypsum board elsewhere. Provide semi-gloss high performance coating for exposed structure and deck in the Train Wash Building. Provide satin or eggshell high performance coating on exposed structure and deck for all other maintenance and train storage areas.

3.3.4.4 PASSENGER ELEVATORS

The Contractor shall provide durable, efficient easily operable hydraulic passenger elevators with capacity, speed, cab size, travel and openings in accordance with the Project Technical Requirements. All other service elevators, lifts and hoists are considered part of the "Industrial Equipment" scope of work.

3.4 STRUCTURAL

The Contractor shall design all building structural systems to meet the requirements of VUSBC (including local amendments) and the WMATA Design Criteria.

3.5 ELECTRICAL

The Contractor shall provide lighting and electrical distribution systems in accordance with the Project Technical Requirements and the specific requirements in the following subsections. General requirements include:

- Electrical and lighting design shall be coordinated with other disciplines to avoid interference with physical elements such as ductwork, fire protection piping and components, communications conduits, ducts, and components, and other similar physical elements.
- Include provisions for equipment anticipated to be added in the future based on the WMATA Design Criteria as minimum requirements and for facilities as shown.
- Provide electrical distribution capacity, space for future circuit breakers, and rough-in conduit to future equipment locations made inaccessible by construction.
- Coordinate lighting levels in areas served by CCTV cameras to ensure that lighting levels match camera sensitivity.
- Provide utilities and appurtenances to support equipment as shown on the Project Contract Drawings or noted in the Project Technical Requirements. The Contractor should note that some of the equipment will be provided by WMATA.

3.5.1 LOAD CLASSIFICATION

Electrical loads are categorized into one of three classifications: (1) Critical, (2) Essential, and (3) Normal. Design feeders and branch circuits that conform to requirements for its corresponding load classification.

a. Critical Loads. Loads that are tolerant neither to prolonged nor momentary interruptions; serve critical loads with an uninterruptible power supply or integral battery backup, such as emergency luminaries capable of continued operation after power is interrupted. Critical loads include, but are not limited to:

- Facility Emergency and Egress Lighting
- Service Platform Extension and Boarding Platform Lighting
- Emergency Signage
- Ventilation Supervisory Controller
- Fiber Optic Backbone
- LAN/WAN Systems
- Critical Signal Systems
- Train Control Equipment
- 480 And 208 Volt Switchgear Control Power
- SCADA System
- Fire Alarm System
- Emergency Trip System

- PA System
- CCTV And Other Security Loads
- Radio

b. Essential Loads. Loads that are not tolerant of prolonged interruptions, but may tolerate momentary interruptions and may, therefore, be served by a redundant power circuit served from two independent feeders from the 34.5 kV loop or an emergency generator feeder and a single feeder from the 34.5 kV loop. Essential loads include, but are not limited to:

- Normal lighting in the S&I and MOW Buildings
- Shop equipment in the S&I and MOW Buildings
- Storm and ground water drainage pumps
- Fire booster pumps

c. Normal Loads. Loads that can tolerate occasional prolonged interruptions and may, therefore, be served by a non-redundant power circuit served from a single electrical utility service feeder or a single service feeder. Normal loads include, but are not limited to:

- Normal lighting not otherwise identified as “essential”
- Yard, parking and roadway lighting
- Miscellaneous above-grade distribution
- Sanitary drainage pumps

3.5.1.1 DEMAND FACTORS

The following demand factors shall apply when sizing transformers, switchgear, switchboards, panelboards, and motor control centers. For equipment configurations that include two busses with an interconnecting tie-breaker, size each bus to no less than 125 percent of the sum of connected loads plus planned future loads of the two busses combined.

Load	Load Factor
Lighting and Signs	1.0
Elevators	0.5
Ventilation equipment	0.8
Air conditioning equipment	0.7*
Heating equipment	1.0*
Shop equipment	0.4
Drainage and ejector pumps	0.7
Signal and communication	1.0
Convenience outlets	1.5 amps per receptacle yoke

* The lesser of non-coincident heating and air-conditioning loads may be excluded.

3.5.1.2 UTILIZATION VOLTAGES

The following utilization voltages shall apply to various electrical equipment and fixtures.

Equipment	Voltages
LIGHTING	
Fluorescent lighting	277V-1PH (preferred) or 120V-1PH
HID Lighting	277V-1PH
Maintenance lighting (elevator pits, etc.)	120V-1PH
Convenience outlets	120V-1PH
MOTORS	
Above 1/2 HP	460V-3PH
1/2 HP and below	115V-1PH
Motor controller power	115V-1PH
DUCT HEATERS	
Below 5 kW	277V-1PH
5 kW and above	480V-3PH
WATER HEATERS	
Below 8 gph recovery	120V-1PH
Between 8 gph – 25 gph recovery	277V-1PH
Above 25 gph recovery	480V-3PH
UNITARY AIR CONDITIONING EQUIPMENT	
10,000 BTUH and below	115V-1PH
Between 10,000 and 36,000 BTUH	208V-1PH
36,000 BTUH and above	460V-3PH
Chillers	460V-3PH

3.5.2 ELECTRICAL SERVICE AND DISTRIBUTION

The Contractor shall provide electrical service and distribution for all Package B facilities and equipment in accordance with the Project Technical Requirements and the specific requirements in the following subsections.

3.5.2.1 BUILDING SERVICE

a. Provide the S&I and MOW Buildings each with an incoming service consisting of two (2) 34.5 kV feeders. Wire each incoming service feeder to a separate and independent circuit from Dominion Virginia Power (DVP) that is electrically and physically isolated from the other. It shall be permitted that each of the two final feeder segments to each building share a common manhole only to the extent that it contains the same DVP circuit. The two primary medium voltage electrical feeders shall come from different electrical substations that in turn are fed by primary electrical feeders of the same length. Route each of the two final 34.5 kV feeder segments from the manhole to a medium voltage switch on the mirrored substation in a separate concrete duct.

b. Provide the Transportation/Police, Warehouse, and Train Wash Buildings each with an incoming service consisting of one (1) 480Y/277-volt feeder. Extend the feeder from a pad-mounted, liquid-filled transformer wired to one of the site's DVP 34.5 kV circuits. It shall be permitted that the final feeder segment to the pad-mounted transformers serving the Transportation/Police and Warehouse Buildings may share a common manhole only if it contains the same DVP circuit.

c. Provide the gate house with an incoming service consisting of one (1) 120/208-volt, 3-phase feeder. Extend the feeder from a pad-mounted, liquid-filled transformer wired to a dedicated 480-volt circuit in on the mirrored substation in the MOW Building. Route 480-volt feeder segments passing through areas subject to vehicle traffic in concrete duct. Provide hand hole access to the circuit adjacent to the MOW Building and adjacent to each side of access roadway crossings.

d. Provide the Vehicle Storage Building with an incoming service consisting of one (1) 120/240-volt, single-phase feeder. Extend the feeder from a wall-mounted, dry-type transformer wired to a dedicated 480-volt circuit. Circuit the hazmat storage buildings from a dedicated feeder from a 480-volt switchboard in the adjacent building. Provide hand hole access to the circuit between the main building and the Vehicle Storage Building.

e. The Contractor shall provide digital metering on the line side of each main breaker, including each main breaker where the mirrored substation is fed directly from the site 34.5 kV distribution. In addition, the Contractor shall provide separate sub-metering of electrical dedicated panelboards/subdistribution to lighting, equipment, and plug/utility service to facilitate energy monitoring and reporting and maintenance analysis.

3.5.2.2 BUILDING MAIN DISTRIBUTION

a. S&I and MOW Buildings.

- Provide each building with two (2) medium-voltage vacuum circuit breakers, two (2) transformers, two (2) 480Y/277-volt low-voltage main-breaker switchgear, and one (1) tie-breaker. Design the equipment as a single package in a three-phase, close-coupled, mirrored unit-substation with a main-tie-main arrangement. Use duplex medium voltage switches in the S&I Building, each equipped to accept one 34.5 kV feed and distribute one 34.5 kV feed to a closed-coupled transformer and the other 34.5 kV feed to a DC rectifier assembly.
- Designate the low voltage bus sections of the mirrored substation as bus "1" and bus "2". Incorporate a kirk-key interlock that prevents closure of main breaker for bus "1" and "2" without first closing the matching medium-voltage switch; likewise, the interlock shall prevent opening of the medium-voltage switch without first opening the matching main breaker on the 480-volt side of the transformer.
- Design main-tie-main for automatic operation of bus 1 and 2. Ensure that automatic operation is inhibited when kirk-key interlock is positioned for maintenance. Conform to the following sequence:

- Normal operation: Where service voltage for bus 1 and 2 are operating normally, main breaker of bus 1 and 2 are closed and tie breaker is open.
- Failure of bus 1(or bus 2): If service voltage of bus 1 (or bus 2) remains out of tolerance for 10 seconds, open main breaker for bus 1 (or bus 2) and close tie breaker.
- Restoration of bus 1 (or bus 2): If service voltage of bus 1 (or bus 2) is subsequently found to be within tolerance for 5 minutes, open tie breaker and close main breaker for bus 1 (or bus 2).
- Provide dedicated circuit breaker on the low voltage switchgear for future emergency generator. Also provide kirk-key interlock that prevents simultaneous closing of the emergency generator breaker and bus 1 and 2 main breakers. Size the tie-breaker, bus, and main of each bus "1" and "2" no less than 125 percent of the sum of connected loads plus planned future loads of the two buses combined.

b. Police/Transportation and Train Wash Buildings. Provide each building with a three-phase molded-case main switchboard consisting of 480Y/277-volt bus, main breaker, and distribution breakers. Also provide a dedicated 10 HP 3-phase, 480-volt circuit to the salt dome.

c. Warehouse Building. Provide building with a three-phase molded-case main panelboard consisting of 480Y/277-volt bus, main breaker, and distribution breakers.

d. Gate House. Provide building with a three-phase molded-case main panelboard consisting of 208Y/120-volt bus, main breaker, and distribution breakers.

e. Vehicle Storage Building. Provide building with a single-phase, three-wire main panelboard appropriately selected for the building's corrosive environment and consisting of 240/120-volt bus, main breaker, and distribution breakers.

3.5.2.3 BUILDING SUB-DISTRIBUTION

- Provide each elevator with a dedicated feeder from the main 480-volt switchboard.
- It is not permitted to subfeed a panelboard from another panelboard, except in arrangements where panelboards are physically located together and share a single main breaker, such a multiple-bus panelboard
- Provide 480Y/277-volt motor control centers (MCC) at strategic locations around the building sufficient to provide efficient and convenient control of clusters of HVAC and other equipment. Circuit each MCC with a dedicated feeder from the 480-volt main switchboard.
- Provide 480Y/277-volt panelboards around the building to serve 480Y/277-volt load clusters. Circuit each panelboard with a dedicated circuit from the 480-volt switchboard.
- Provide 208Y/120-volt panelboards around the building to serve 208Y/120-volt load clusters. Feed each panelboard from a dedicated circuit from a nearby 480Y/277-volt switchboard through a 480 Delta-208Y/120 V, three-phase transformer. Use of a 208Y/120-volt switchboard to serve multiple 208Y/120-volt panelboards is permitted.

- Organize distribution equipment for efficient and convenient circuiting of loads. Conform to the following additional requirements:
- Dedicated panelboards for lighting loads
- Dedicated panelboards for office lighting loads
- Dedicated panelboards for yard, parking, and roadway lighting loads
- Dedicated panelboards for office receptacles loads
- Dedicated panelboards for HVAC equipment
- Dedicated MCCs for HVAC equipment
- Loads on multiple floors served from a single panelboard not permitted.

a. S&I and MOW Buildings.

- In the S&I Building, provide (2) 34.5 kV feeders, one from each duplex medium voltage switch on the mirrored substation, to the traction power rectifier assembly. Ensure that selectivity of the duplex medium voltage switch permits independent control of the power to the traction power rectifier and the transformer on the AC substation. Provide a dedicated feeder from the low voltage switchgear to each elevator. Assign half of the elevator feeders to bus 1 and the remaining to bus 2.
- Provide several 480Y/277-volt switchboards strategically-located around the building to provide an efficient and convenient 480Y/277-volt distribution backbone that is sufficient to limit voltage drop and intelligently group electrical loads. Feed each switchboard from a dedicated circuit from the main low voltage switchgear. Assign half of the switchboard feeders to bus 1 and the remaining to bus 2.
- Provide 480Y/277-volt motor control centers (MCC) at strategic locations around the building sufficient to provide efficient and convenient control of clusters of HVAC and shop equipment. Provide a dedicated feeder from the main low voltage switchgear to each MCC. Assign half of the MCC feeders to bus 1 and the remaining to bus 2. Circuiting an MCC except to the main low voltage switchgear is not permitted.
- Provide a 480Y/277-volt UPS distribution panelboard fed from a modular, scalable, three-phase, UPS system. Feed UPS from a dedicated feeder from the low-voltage switchgear. Position 480 Delta-208Y/120 V, three-phase transformers and 208Y/120-volt UPS panelboards at various locations around the building sufficient to provide efficient and convenient 208Y/120-volt UPS distribution.

b. Monitor and Control. Provide a Building Automation System (BAS) in accordance with the Project Technical Requirements, with the following monitor and control features:

- Monitor the status of each load, main and tie breaker of the S&I and MOW main switchgear as OPEN, CLOSED, or TRIPPED. TRIPPED status must also include whether trip was due to LONG-TERM, SHORT-TERM, INSTANTANEOUS, or GROUND FAULT trip. Identify each device by switchgear number, cabinet position, and plain language description of load. Graphically display status on a visual mimic screen to depict a single-line diagram of the switchgear with switch positions and power flow.

- Monitor the status of the main device in each MCC as OPEN, CLOSED, or TRIPPED. Identify each point with MCC number and physical location. Graphically display status on a visual mimic screen to depict a single-line diagram of the MCC with switch positions and power flow.
- Monitor the status of each load device in each MCC as OPEN, CLOSED, or TRIPPED. Identify each device by MCC, MCC cabinet position, and plain language description of load. Graphically display status on a visual mimic screen.
- Monitor the status of the PLC in each switchgear and MCC as ON, OFF, or TROUBLE. Identify each point with switchgear or MCC number and physical location. Graphically display status on a visual mimic screen.
- Monitor status of the UPS, including a mimic screen to depict a single-line diagram of the UPS with switch positions and power flow, and plain-language indication of the following:
    - UPS NORMAL
    - UPS TROUBLE
    - UPS IN BYPASS
    - UPS BATTERY CHARGING
    - UPS BATTERY CHARGING ELAPSED TIME
    - UPS ON BATTERY
    - UPS-ON-BATTERY ELAPSED TIME
- Control load breakers on the main switchgear of the S&I and MOW Buildings such that each breaker may be manually OPENED or CLOSED individually. Graphically display status on a visual mimic screen.
- Control the tie and both mains of each mirrored substation such that the BAS may override the main-tie-main control of each mirrored substation so that (1) a single mirrored substation is in non-automatic mode where the tie and both main breakers may be manually OPENED or CLOSED individually, or (2) place a single mirrored substation in automatic mode where the main-tie-main operational OPEN/CLOSE sequence is controlled from the switchgear's resident PLC. Neither control mode shall interfere with the trip operation of any breaker. Graphically display status on a visual mimic screen.

3.5.2.4 COORDINATION AND LOAD STUDIES.

a. Prepare an engineering analysis on each distribution system, including a short-circuit analysis with protective device evaluation, a protective device coordination study, load flow/voltage drop study, and a motor starting study. Engineering analysis shall be performed by a professional electrical engineer registered in the Commonwealth of Virginia with a history of experience in short circuit and coordination studies.

b. Comply with IEEE 141 and include time-current characteristic curves, a single-line diagram, plus an analysis narrative that describes the system coordination, recommended ratings, and settings of protective relays to maximize selectivity. Prepare calculations with a computer that utilizes a commercially available short circuit and

coordination software package. Use the design fault level of 500 MVA. Lower fault assumptions may be used if justified by written affirmation by Dominion Virginia Power, but not less than 80 MVA.

c. With the energy information obtained from the short circuit study, perform an arc flash study to determine PPE levels for equipment identified in NFPA-70 (110.16) and provide arc flash hazard labeling per ANSI Z535.4, complete with incident energy and PPE protection level per NFPA-70.

d. Perform a load flow/voltage drop study to determine the steady state load profile during full simultaneous loading, plus an analysis of the transient effect of the system's voltage profile during motor starting condition. Prepare calculations with a computer utilizing commercially available software.

3.5.2.5 DESIGN DOCUMENTATION

a. Provide plans and details on drawings showing physical arrangement and elevations with dimensions for major electrical and mechanical equipment, raceways, cable tray, junction boxes, and other items in sufficient detail that the design and construction can be coordinated with mechanical, architectural, structural, and other disciplines.

b. Provide schedules on drawings that permit easy reference of electrical information, including, but limited to the following:

- Motor and equipment schedule that identifies mechanical equipment, such as air conditioners, fans, escalators, elevators, and heaters. Construct schedule to provide complete information on circuit and circuiting, controller size and type, disconnect size and type, control information such as SCADA interface or interlock with fire protection and alarm, and plan mark or ID.
- Feeder schedule that lists equipment served by feeders, such as switchgear, condensers, transformers, switchboards, panel boards, motor control centers, and major mechanical equipment, particularly equipment fed from the 480 volt switchgear. Construct schedule to identify source and load; cable type, size, and quantity; wire management information such as conduit type and size, and plan mark or conduit ID, using WMATA standard conduit identification scheme.
- Motor control center (MCC) schedule for each MCC that lists MCC loads. Construct schedule to identify MCC voltage; MCC main size, type, and AIC rating; horizontal and vertical bus size and bus bracing; individual load ratings; starter types, sizes, and filter information; complete information on over-current protection and disconnect means; and plan mark or ID for each load and for the MCC itself.
- Panel schedules for each panelboard that lists panelboard loads. Construct schedule to identify panel voltage; panel main size, type, and AIC rating; individual circuit number and load ratings per phase; breaker configuration and rating; wire sizes; identification of spaces for future connection of breakers (spaces) and unconnected circuit breakers (spares); and panelboard plan mark or ID.

c. Provide single line diagram that depicts, as a minimum, all feeders shown on the feeder schedule. Include the following information:

- Incoming lines (voltage and size —capacity and rating)
- Incoming main and tie breakers
- Power transformers (rating, winding connection and grounding means)
- Distribution equipment such as switchgear, motor control centers, and switchboards (main type, main and distribution ratings, AIC ratings, and grounding means)
- Feeder breakers and fused switches (function, use and type)
- Current/potential transformers (size, type and ratio)
- All main cable and wire runs with their associated isolating switches
- Critical equipment voltage and size (UPS, battery (backup time), generator, power distribution, transfer switch)

d. Provide grounding diagrams for each building. Identify major pieces of equipment, sizes and locations of bus bars, and grounding schemes. Provide single point grounding for Communications and Train Control equipment.

e. Provide operational and maintenance manual for major electrical equipment, particularly equipment with serviceable parts. Include manufacturer's operation and maintenance instructions, wiring diagrams, elementary control and power diagrams, lists of spare parts, and recommended stock quantities for one year routine maintenance and repair. Include a copy of approved drawings.

3.5.3 LIGHTING DESIGN

The Contractor shall provide lighting for all Package B buildings and facilities. Lighting systems shall classified as either (1) Normal or (2) Emergency.

a. Normal. Lighting functions that can tolerate occasional prolonged interruptions (greater than 10 seconds). Subject to other criteria requirements, there are no limitations. Examples of normal lighting include: Yard, parking, and roadway lighting and exterior pedestrian walkways.

b. Emergency. Lighting that cannot tolerate prolonged interruption (greater than 10 seconds). Examples of emergency lighting include: emergency egress signage.

3.5.3.1 MINIMUM ILLUMINATION LEVELS.

Conform to the illumination levels listed below. All levels shown are minimum average maintained horizontal illumination, expressed in foot-candles (FC) at 30" above finished floor, unless noted.

Application	Minimum Illumination Levels (FC)
Open Shop; Common Work Areas	50 (see Note 1)
Mechanical/Electric Rooms	50
Telecom/Systems Equipment Rooms	50
Lube/Compressor	50
Private/Semi-Private Offices	50
Other Continuously-Occupied Admin Spaces	50
OPS Control Rooms	50 (see Note 2)
Conference Rooms	50
Tool Storage	20
Other Active Storage	20
Inactive Storage	5
Breakroom/Canteen/Vending	30
Other Transient-Occupied Admin Spaces	30
Toilet/Shower/Locker	10
Custodian	10
Stair Landings	10
Foyers	10
Building Entrance	10
Corridor	5
Stairs Treads	5
Vehicle Storage	2
Yards	2
Track Switch Area	5
Interlock Area	30
Parking Lots	2
Pedestrian Walkways	5
Roadway Lighting (access roadways)	1 (See Note 3)

Notes:

1. The required illumination levels shall be achieved with all shop equipment, including elevated platforms, installed and with railcars on the car lifts in the raised position.
2. Illumination level is minimum maintained point, not average.
3. Comply with illuminance criteria for roadway lighting in IESNA RP-8-00, Subsection 3.1

3.5.3.2 AREAS OF CONVERGENCE.

a. Design lighting systems to accommodate pedestrian and vehicular circulation patterns. Pay particular attention to decision points, conflict areas, changes in elevation or environment, such as: Roadway intersections and crosswalks and Entrances

b. Provide lighting level contrast to accentuate these areas from surrounding spaces. Enhanced illumination of certain conflict areas and decision points are listed in the Table of Minimum Illumination Levels.

3.5.3.3 ILLUMINATED SIGNAGE.

The Contractor shall provide and use artificial lighting to emphasize directional and informational signage. Signage and graphics may be illuminated internally or externally. Supply directional and information signage from normal power.

a. Roadways.

- Design roadway lighting using WMATA standard pole-mounted luminaires.
- Provide enhanced lighting at traffic conflict areas, such as vehicle intersections, merges, and crosswalks in accordance with IESNA RP-8-00.

b. Parking Areas. Provide WMATA standard pole-mounted luminaires.

c. Yards. Provide WMATA standard pole mounted luminaires.

d. Light Trespass. Position outdoor luminaires to minimize glare to train operators, motorists, or adjacent properties and use shields where necessary. This is particularly critical in residential areas

e. Energy Conservation.

- Provide timers to turn lights on and off on a set schedule, triggered to any operational activity.
- Provide dimmers to reduce the wattage and output of incandescent and fluorescent lamps.
- Provide photocells/photo sensors on exterior fixtures.
- Provide occupancy sensors for interior spaces.
- Control yard, parking, and roadway lighting by employing either (1) astronomical clock feature calibrated for the geographical location of the Rail Yard and Maintenance Facility, or (2) photo sensor. Provide the capability to allow lighting systems to run automatically or to manually force individual lighting systems ON or OFF.

f. Photometric Calculations. Prepare point-by-point graphic lighting calculations using commercially-available and industry-recognized lighting calculation software (such as AGi32 or Visual Professional) that complies with IESNA processes and has been

independently validated using CIE 171 or other approved means. Include maximum, minimum, and average illumination levels along the appropriate uniformity ratios and lighting power densities. Also include luminaire locations, mounting heights, manufacturer catalog data sheet, wattage, lumen output, color rendering index, color temperature, room surface reflectance values, light loss factors, and photometric file used.

g. Obtain actual reflectance values corresponding to the actual materials and colors. Use the following reflectances if the actual values are not available:

   - Interior Office Spaces: Ceiling 80 percent, wall 50 percent, and floor 20 percent.
   - Interior Shop/Warehouse Spaces: Ceiling 50 percent, wall 30 percent, and floor 20 percent.

h. Calculate light loss factors (LLF) as LLF = LLD x LDD x BF. Conform to the following LLDs in calculations:

Lamp	**LLD**
T8 linear fluorescent	95 percent
T5 linear fluorescent	95 percent
CFL compact fluorescent	90 percent
HPS high pressure sodium	84 percent
MH metal halide	68 percent
LED light emitting diode	80 percent

i. Obtain the luminaire maintenance category from the manufacturer and cross-reference with LDD graphs in the IESNA Handbook. Assume an average environment and a 30-month cleaning cycle for all spaces, except open shop areas shall assume a dirty environment and 30-month cleaning cycle.

j. Obtain the BF from the ballast manufacturer for the particular lamp-ballast system.

k. Provide plans and details on drawings showing physical arrangement of luminaires, poles, circuit panels, and controllers (such as contactors, motion sensors, timers, and photocells) and other items in sufficient detail that the design and construction can be coordinated with mechanical, architectural, structural, and other disciplines.

l. Provide schedules on drawings that permit easy reference of electrical, illumination, and physical information, including a lighting schedule with the following information:

   - Luminaire type and brief, but descriptive physical description
   - Manufacturer
   - Model or part number

- Lamp quantity and description
- Ballast quantity and description
- Mounting description, including pole and mast arm
- Voltage and load
- Luminaire symbol and plan mark or ID

3.5.3.4 EQUIPMENT AND MATERIALS.

The Contractor shall provide equipment, components, and materials in accordance with the Project Technical Requirements and that have been listed and labeled by the Underwriters Laboratory (UL) or other testing agency acceptable to the Airports Authority and WMATA, and marked for its intended use.

3.5.3.5 LAMPS.

The Contractor shall provide lamps in accordance with the Project Technical Requirements and as noted below. The following lamps are suitable for use:

- Bonding of doors and instrument cover plates with flexible copper braid.
- T5 and T8 fluorescent lamps.
- CFL compact fluorescent.
- Pulse-start metal halide lamps.
- Ceramic metal halide lamps.

Lamp types that are not permitted include:

- Incandescent lamps of any kind.
- Probe-start metal halide lamps; pulse-start and ceramic metal halide lamps are still permitted.
- T12 fluorescent lamps.
- Low pressure sodium lamps of any kind.
- Mercury vapor lamps of any kind.
- Pulse-start high pressure sodium lamps.

a. Luminaires. Provide luminaires that conform to WMATA standards and Project Technical Requirements, unless otherwise noted.

b. Pole Luminaire. Provide yard, parking, and roadway pole luminaires with the following features:

- Basic description: Flat-glass, full-cutoff roadway luminaire.
- Arm: standard design, compatible with the luminaire
- Lens: removable tempered flat glass

- Lamp: TLCP-compliant, high-pressure sodium and pulse-start metal halide (conform to one or the other)
- Optical Reflector: cutoff classification with either Type II or Type III distribution

c. Pedestrian Pole Luminaire. Provide pedestrian pole luminaires with the following features:

- Basic description: Flat-glass, full-cutoff luminaire, consistent in styling and color as the parking pole luminaire.
- Arm: standard design, compatible with the luminaire
- Lens: removable tempered flat glass
- Lamp: TCLP-compliant, high-pressure sodium and pulse-start metal halide (match parking pole luminaire)
- Optical Reflector: cutoff classification with either Type III or IV distribution.

d. Wet-Location Luminaire. Provide luminaires for blow-down pits, train wash and other open shop areas subject to incidental exposure to pressurized water jets with the following features:

- Basic description: Direct- or chain-mounted, 4 or 6 lamp enclosed fluorescent luminaire.
- Housing: closed-cell gasketed, one-piece fiberglass with tool-less, stainless steel latches for ballast and wiring access.
- Lens: Impact-resistant clear acrylic diffuser with frosted ends.
- Lamp: 4 or 6 32WT8 fluorescent lamp; color: 4100K.
- Optical Reflector: precision-formed, specular aluminum reflector.

e. Low Clearance Shop Luminaire. Provide luminaires for open shop and other unfinished areas with less than 18-feet of overhead clearance with following features:

- Basic description: Direct- or chain-mounted open fluorescent luminaire.
- Housing: heavy-duty formed steel channel with white polyester powder-coat finish.
- Lamp: 2, 3, or 4 32WT8 fluorescent lamp; color: 4100K.
- Optical Reflector: solid-top reflector with high-gloss, baked white polyester finish.

f. High Clearance Shop Luminaire. Provide luminaires for open shop and other unfinished areas with greater than 18-feet of overhead clearance with following features:

- Basic description: Direct-mounted, open-reflector HID hi-bay.
- Housing: Heavy-duty die-cast aluminum with white polyester powder-coat finish with reflector mounted with heavy-gauge rings and rods fitted to top and bottom of reflector and a self-cleaning, ventilated design to carry optical contaminants out through top of reflector.

- Lamp: vertically-oriented, mogul-based, “0”-rated protected, pulse-start metal-halide lamps, using protected, exclusionary “pink” socket.
- Optical Reflector: High-efficiency, high performance, heat-resistant borosilicate glass.

g. Office Luminaire. Provide luminaires for confined finished areas, such as offices, admin stations, conference rooms and other spaces that require low glare and high visual comfort with the following features:

- Basic description: low-profile 2, 3, or 4-lamp fluorescent, parabolic-louvered, nonplenum troffer for recessed, grid T-bar ceiling mounting.
- Housing: low-profile, painted steel housing with hemmed-edges.
- Lamp: 2, 3, or 4 32WT8 fluorescent lamp; color: 3500K.
- Optical Reflector: 18-cell, low-iridescent, anodized specular silver.

h. Yard Lighting. Locate yard luminaire poles to accommodate the dynamic envelope of the train vehicles in accordance with the Project Technical Requirements. Maintain the following minimum horizontal distances of poles from surface and underground features:

- Fire Hydrants and Storm Drainage Piping: 5 feet.
- Water, Gas, Electric, Communication, and Sewer Lines and Manholes: 10 feet.
- Electric and Communications Handholes (not serving the pole): 5 feet.
- Trees: 16 feet from trunk

In addition to the required subsurface depth of the concrete foundation, provide roadway and parking luminaire pole bases with an above-ground height of 3 FT. In yard areas, above-ground component of yard luminaire pole bases are not permitted to exceed six inches.

Provide an equipment grounding conductor that bonds the pole to the equipment ground bar back in the source circuit panel; a local ground electrode (ground rod) shall not be permitted to satisfy this grounding provision.

3.6 MECHANICAL

The Contractor shall provide all mechanical equipment and appurtenances necessary to support such equipment in accordance with the Project Technical Requirements and as necessary to deliver a complete functioning and operational yard and supporting complex of buildings as described herein.

No mechanical equipment shall be installed where access is limited by work of other trades or non-mechanical equipment/system placement - including elevator, escalator, lighting fixtures, plumbing, process piping, etc. would encroach on safe access to mechanical systems for all maintenance purposes.

3.6.1 HVAC SYSTEMS

The Contractor shall provide a Heating, Ventilation and Air Conditioning (HVAC) system in accordance with the Project Technical Requirements and the following subsections. The system shall provide building and service room environments that satisfy the temperature and humidity requirements of all systems and equipment. Where systems and equipment require temperature and humidity control exceeding that available through ventilation means alone, the Contractor shall provide heating and/or cooling to ensure operational parameters are not exceeded.

3.6.1.1 DESIGN PARAMETERS:

The HVAC systems described in this document shall be considered the minimum level of quality, efficiency, occupant comfort potential and controllability required.

a. Heating, Ventilation and Air Conditioning.

- All enclosed occupied building areas shall be provided with heating and ventilation in accordance with code requirements, applicable standards and design criteria..
- HVAC controls shall be based on a Building Automation System (BAS) and provide for occupant comfort control. Zone interior spaces together, separate from exterior spaces. Do not zone enclosed office spaces with open areas. Zone each conference room, break room/lunchroom, and training room separately. The spaces shall be zoned such that space with similar use and occupancy are on the same air-handling unit. The Office areas shall be designed to provide a positive pressure relationship as compared to surrounding areas to reduce infiltration from the outside and Maintenance areas.
- Mechanical systems shall have control settings for occupied, unoccupied, and temporary override.
- Restroom areas shall be negative pressure, drawing air from adjacent spaces for ventilation.
- Maintenance areas shall be ventilated and heated, and maintain adequate air movement for mechanic comfort.
- Maintenance shop areas shall be exhausted as required to prevent accumulation of explosive mixtures.

- Provide for smoke and heat venting of repair areas. Make use of smoke curtain boards as required.

b. Exhaust Ventilation.

- Exhaust ventilation shall be provided in accordance with all applicable codes and NFPA and ASHRAE standards, and shall discharge outdoors.
- Dust collection systems shall be installed and maintained in compliance with all applicable codes. Use 3500 fpm minimum duct velocity for woodworking dusts.

  Dedicated exhaust systems shall be provided for welding and applicable machine shop operations such as grinders. Provide moveable direct capture hoods designed to provide a capture velocity of not less than 150 feet per minute over the cross sectional area. Each hood shall be provided with a blast gate to allow balancing and shutoff. The exhaust duct system shall be designed to the SMACNA pressure class which the suction of the exhaust fan will generate at the “dead head” condition but in no case less than 5” w.g. Use 4000 fpm minimum duct velocity for metalworking dusts.

c. Mechanical/Equipment Rooms.

- Coordinate the size and location of mechanical and equipment rooms and utility chases with the building design.
- Mechanical room sizing shall take exchanger tube and air filter removal, as well as other common maintenance activity clearance requirements, into account as well as space and clearance required by ASHRAE and building codes.

d. Equipment Access.

- Work platforms shall be provided for major mechanical equipment items mounted 8 feet or higher above the finish floor.
- Access to work platforms less than 10 feet shall be by portable ladder.
- Fixed ladders shall be provided to work platforms 10 feet or more in height.

3.6.2 VENTILATION SYSTEMS

- Provide systems in accordance with the Project Technical Requirements and as described herein.
- Spaces not described herein shall be ventilated as per the more stringent of International Mechanical Code (IMC) as amended by the local jurisdiction in effect at the time of the design or ASHRAE 62.1.
- All outside air shall be filtered before building distribution.
- As a result of large make-up air and exhaust requirements, heat recovery shall be used wherever the exhaust stream allows for its use and per ASHRAE 90.1. The type and application of the heat recovery system selected shall be appropriate for the quality of heat available from and the nature of the exhaust stream.

- Provide the ventilation and exhaust fans with variable frequency drives (VFD). Where a VFD is not feasible for direct drive fractional motors less than ¾ hp, use a fan speed controller.
- For service rooms with ventilation and no air conditioning, provide the greater of ventilation necessary to maintain space temperature 10°F above outside air temperature, or the specified ventilation rates. Where the ventilation rate for space temperature control exceeds minimum airflow specified, variable speed fans may be used to reduce airflow to minimum requirements for energy conservation.

a. AC Switchboard Rooms.

- Provide two fans of equal capacity. A room thermostat shall cycle the lead fan when the room temperature reaches 90°F. The two fans shall not operate simultaneously except when under manual control. During each cycle, one fan shall serve as a stand-by which will operate only upon failure of the lead fan. Lead fan and stand-by fan shall alternate automatically after each operating cycle. Provide a H-O-A switch for each fan. Provide controls such that the air intake dampers remain closed when neither fan is operating. During operation of any one fan, the intake damper with other fan shall be closed. The fans shall be located on the supply side of the system. The ductwork, air distribution system, intake and relief louvers and dampers shall be sized for one fan operation. Relief air shall be discharged to a point outside of the building unless otherwise approved by the Airports Authority. Supply air shall be from a point outside of building filtered through a cartridge filter sized for one fan operation and discharged into the AC Switchboard Room to maintain a positive pressure of 0.1 inch of water gauge within the room with respect to adjacent space. Air quantities for each fan shall be based on the actual heat gains of equipment or the following minimum values, whichever is greater:
- Single AC Switchboard Rooms - 8 cfm per kVA for the total output rating of the main and auxiliary transformers and 51 cfm per kVA for the total output rating of the uninterrupted power system.
- Combined AC Switchboard Rooms - 8 cfm per kVA for 65% of the combined total output rating of the two main transformers, 8 cfm per kVA of the total output rating of the auxiliary transformers, and 51 cfm per kVA of the total output rating of the uninterrupted power system. When it is determined that a combined switchboard room has only essential loads, reference Electrical Program Criteria, provide 8 cfm per kVA for only 50% of the combined total output rating of the two main transformers. If the switchgear and transformers are located in separate rooms, the air shall be distributed in proportion to the load in each room. Transfer of air from one room to the other is not allowed. Provide tight fitting, weather-stripped doors with no undercuts on underground AC Switchboard Rooms.
- Coordinate humidity control requirements with Airports Authority.

b. DC Switchboard Rooms. Air quantities shall be based on the actual heat gains of equipment or the following minimum values, whichever is greater.

- Below Grade Supply: Provide a minimum of eight air changes per hour. Provide a H-O-A switch. Air shall be drawn from and discharged to a point outside of the building unless otherwise approved by the Airports Authority, filtered, and discharged into the Switchboard room so as to maintain a positive pressure not exceeding 0.1"WG

within the room. Provide tight fitting, weather-stripped doors with no undercuts. Fan shall be operated by a thermostat to maintain room temperature of 90°F.

- At-Grade Supply: Provide eight air changes per hour. Air shall be drawn from and discharged to a point outside of the building unless otherwise approved by the Airports Authority, filtered, and discharged into the Switchboard room so as to maintain a positive pressure not exceeding 0.1"WG within the Fan shall be operated by a thermostat to maintain room temperature of 90°F.

c. Battery Charging Rooms.

- The ventilation exhaust system shall be operated continuously and shall maintain the Hydrogen concentration less than 1% in accordance with the International Fire Code Section 608.6.
- Ventilation Air shall be drawn from adjacent Switchboard Rooms and discharged to a point outside of the building unless otherwise approved. Additional filtering is not required. Provide tight fitting, weather-stripped doors with no undercuts on underground Battery Rooms.
- Suspended ceilings are not allowed. Battery Rooms shall be under negative pressure not to exceed 0.1"WG.

d. UPS Rooms. The ventilation exhaust system shall be operated continuously and shall maintain the Hydrogen concentration less than 1% in accordance with the International Fire Code Section 608.6 Ventilation.

- The supply air to the space shall be at 90% of the exhaust rate to prevent vapors from exiting the space. Exhaust ducts shall have intakes within 6 inches of the highest part of the ceiling to exhaust any hydrogen produced by battery charging.
- A secondary ventilation system, which can be the room ventilation system, shall be operated by a hydrogen activated sensor system that turns the fan on at a hydrogen concentration of 1%. The secondary ventilation shall be greater than or equal to the primary continuous exhaust system. The hydrogen sensor shall also have a local visual and audible alarm and a remote alarm function. It shall also have a second alarm both local and remote for a hydrogen level of 2%.

e. Train Control, Dispatch, and Communications Rooms.

- Provide air conditioning with 0.3 CFM of filtered, outside air per square foot of floor area or 15 CFM per person, whichever is greater.
- Calculate and use actual heat gains and as a minimum use the following: Train control room is estimated to have 8,000 watts of internal electrical heat load, plus a lighting load of 4 watts per square foot. Communication Room is estimated to have 6,000 watts of internal electrical heat load plus a lighting load of 4 watts per square foot. Train Control and Communications Rooms doors shall be tight fitting with no undercutting for relief air. Relief venting of these rooms shall be accomplished by means of adjustable, motorized dampers. Dampers shall be sized at 1100 feet per minute to maintain slight positive pressure in the rooms.

f. Maintenance Areas.

- Air handling units servicing the maintenance areas shall be mounted on elevated mezzanines. The supply air shall be ducted, with the ductwork being fabricated of materials appropriate for the environment they are serving. Where air is to be distributed in high bay areas (20-foot+) the use of high velocity drum type diffusers shall be considered. The ductwork shall be constructed in accordance with SMACNA standards as appropriate for the pressure class of the system and units being served.
- The maintenance area air handling units shall be equipped with variable frequency drives (VFD). The supply fan shall operate at minimum speed and maintain minimum make-up air volume based on the space use. As the space exhaust air demand increases the VFD shall increase supply fan speed to maintain space pressurization. The space pressurization shall be monitored through the use of space pressure sensors. The air handling units shall be designed for 100 percent of the heat recovery exhaust fan and 50% of the roof top centrifugal exhaust fan volumes.
- The maintenance area general exhaust shall be accomplished through a combination of heat recovery exhaust fans and roof top centrifugal exhaust fans. The heat recovery exhaust fans shall be sized to handle the minimum ventilation rate of 4 air changes per hour. The roof top centrifugal exhaust fans shall be sized such that their total exhaust volume will provide not less than 8 air changes per hour. The ductwork from the heat recovery exhaust fans shall be such that 50% of the exhaust air is taken from 6" above the finished floor. The ductwork that is run down to the floor level intakes shall be attached and run down walls or columns and be protected from impact damage.

g. Train Wash Area. Provide a minimum of 4 air changes per hour on low speed and 8 air changes per hour at high speed. On, off and fan speed control shall be controlled by the train wash PLC. High speed shall be activated when a wash cycle is started. The low speed shall be engaged once the train has cleared the wash andshall run for 20 minutes.

h. Restrooms, Locker Rooms, Custodial Rooms, and Sewage Ejector Rooms Custodial and Sewage Ejector Rooms exhaust air: minimum 2-1/2 cfm per square foot of floor area, exhausted to outside.

- Each locker room and restroom shall be designed with supply air and exhaust system. The space exhaust air shall be designed for 2-1/2 cfm per square foot of floor area or the sum of 75 cfm per water closet and urinal; 50 cfm per shower; and 15 cfm per locker, whichever is greater. The supply/make-up air shall be designed at 90 percent of the exhaust volume to provide a pressure differential between Locker/Restroom and the surrounding area.

i. Basement Areas. Wheel truck lift equipment rooms shall be ventilated, unless noted otherwise, during the summer to remove heat gain from all sources with a temperature rise of 10°F. The winter ventilation rate shall be based on the IMC in effect at the time of design.

j. Elevator Machine Rooms. Provide necessary ventilation in accordance with the Project Technical Requirements.

k. Air Compressor, Lube, Mechanical and Electric Equipment Rooms.

- Provide mechanical ventilation supply and exhaust air to remove heat gain from all sources with a temperature rise of 10°F. For mechanical rooms with boilers, provide ventilation requirements per code for combustion air, minimum of 10 cfm / boiler hp. For compressor rooms provide make-up air for compressor intake and heating to offset the ventilation load.
- Provide demand control ventilation (e.g. CO_2 sensors) for the varying high occupancy areas. The office areas shall be designed to provide a minimum of 15 cfm per person of outdoor air. Provide 1 cfm/sf minimum of total airflow for office areas and a minimum of 0.5 cfm/sf of total airflow in corridors.

l. Shop Areas. Provide a minimum of 0.5 cfm/sf of total airflow and a minimum of 15 cfm/person of outside air.

m. Storage Rooms. Provide ASHRAE or code mandated air changes per hour exhaust airflow based on the contents and usage of the storage area with 90% makeup air.

3.6.3 HEATING SYSTEMS

The Contractor shall provide heating systems with the Project Technical Requirements and the requirements specified herein. The primary heating shall be a hot water design. Where hot water heating is not practical, natural gas heating or electric resistance heat shall be used. Wall heaters, unit heaters, duct heaters or combination heating/cooling units may be employed as required by the application. Convective type wall heaters are preferred to force-flow types provided units are available in the required capacity.

a. Design Temperature. Heating design dry-bulb temperatures for areas are as follows unless noted otherwise:

- AC Switchboard Rooms: Provide heat to maintain 72°F. Normal setpoint shall be 50°F. Higher temperatures will be maintained during extended maintenance operations. Calculations of heating load shall include a deduction of 10,000 BTU per hour for each 100 KVA of transformer capacity.
- DC Switchboard Rooms - Provide heat to maintain 72°F. Normal setpoint shall be 50°F. Higher temperatures will be maintained during extended maintenance operations.
- UPS Rooms - Provide heating to maintain 72°F. Normal setpoint shall be 50°F. Higher temperatures will be maintained during extended maintenance operations. Assume heat gain from the adjoining AC switchboard room equal to one percent of the rated capacity of the transformers in the switchboard room.
- Train Control and Communications Rooms, 68°F.
- Dispatch, Operations, and Trainmens' Rooms, 70°F. Deductions shall not be made for internal loads in the computation of heating load.
- Maintenance areas - 65°F
- Electrical and Mechanical rooms, 65°F.

- Office areas, lunch room, Rest rooms and Locker rooms, Shop areas, Basement Shop area, and Stairwells shall be heated to maintain a temperature of 70°F.

b. Boilers.

- The boilers shall be fire tube type, each design sized to meet 80% of the design day heating load as a minimum. Design heating load shall be based on ASHRAE Winter Design Dry Bulb 95% and 80% of maximum building ventilation load.
- The boilers shall be equipped with dual fuel, modulating type power assisted burners that shall be capable of operation on natural gas and/or No. 2 fuel oil as available and acceptable to WMATA. The burners shall be designed to swing out allowing full burner face access without having to disconnect fuel piping or wiring. The burners shall have full IRI gas and oil trains and be provided with a combined burner management and flame safeguard system. The burner management system shall be capable of providing lead/lag changeover and fuel selection functions.
- No. 2 fuel oil shall be pumped to the boilers from an exterior underground oil tank capable of storing one (1) month's oil at fully loaded boiler operation. The tank shall be dual wall fiberglass design and be provided with leak detection system. Ancillary tank equipment such as oil fill boxes, vents, manholes, oil level indicators, anti-syphon valves, and alarms shall be provided. The fuel oil transfer pumps shall be skid mounted duplex type each being capable of providing sufficient oil for both boilers operating 100% loaded.
- The boiler flue venting shall be accomplished through a pre-manufactured stainless steel flue system. The flue system shall be designed in accordance with NFPA requirements. Design shall include make-up air to the boiler room to provide for boiler combustion and ventilation requirements.
- Provide water treatment for the hot water heating system to prevent scale, corrosion, fouling and microbiological growth.
- Provide variable speed base-mounted centrifugal pumps to serve the hot water heating system(s).

c. Heating Equipment. Building heating systems shall be provided in accordance with the Project Technical Requirements. All heating equipment shall be thermostatically controlled.

d. Special Systems.

- Entrances and Exits: Heated air curtains shall be provided at all train entrances and exits as well as all overhead-door service area entrances in accordance with the Project Technical Requirements. All air curtains shall be designed for the local winter wind velocity as identified in the latest version of the ASHRAE fundamentals. Air curtains supply air temperature shall be tempered to a minimum of 50°F DB.
- Parts Storage Rooms: The Parts Storage Room shall be served by its own air-handling unit. Space temperature shall be maintained at 70°F. The hazardous storage rooms shall be designed to Class I, Division 2 requirements (NFPA30) and space temperature shall be maintained at 65°F.

- Train Wash Area: The Train Wash Area shall be designed utilizing a combination of space air handling and high intensity, infrared gas-fired unit heaters designed for a wet environment. The system shall be designed to maintain a space temperature of 65°F, and accommodate overhead obstructions and to provide sufficient clearances below the heaters to avoid damage to objects.

3.6.4 AIR CONDITIONING SYSTEMS

The Contractor shall provide air-conditioning systems with the Project Technical Requirements and the requirements specified herein. Air conditioning shall be provided in rooms where personnel are stationed for extended periods of time unless noted otherwise (see Table 3-1) or where equipment operation requires lower temperatures than can be provided by outdoor air ventilation.

- All office areas, lunch rooms, locker rooms, control rooms and restrooms shall be air-conditioned to maintain a temperature of 72°F.
- Enclosed shop areas shall be air-conditioned to maintain a temperature of 78°F.
- Operations Rooms and Dispatcher's Rooms - Provide air conditioning designed for two occupants and a lighting load of 4 watts per square foot. Provide manual on/off control. In the case of underground rooms, use split system air conditioning units. Locate condensers in areas where exposure to dust is minimized. Small capacity self contained air conditioning units are acceptable for use in isolated rooms above ground.

a. Design Conditions.

- The following conditions shall be used in the selection of equipment and design of air conditioning systems:
- Ambient summer design conditions: 91.0°F Dry Bulb and 77.0°F Wet Bulb
- Design room conditions at peak load: 72°F Dry Bulb / 50% RH unless noted otherwise.

b. Air Conditioning Equipment.

- Air conditioning equipment shall be variable-air-volume (VAV) self-contained (e.g. packaged rooftop units), air handling units or split system type. Provide cooling with DX coils and heating primarily with hot-water coils. Where hot water heating is not accessible, natural gas heating or electric resistance heat shall be used. Thermostatic control shall be provided and tied into the Building Automation System (BAS). Control voltage shall not exceed 120 volts.
- Energy recovery unit(s) shall be shall be provided for both sensible and latent energy transfer where required by ASHRAE 90.1 and where justified for energy savings in pursuit of LEED certification points. The energy recovery unit(s) shall include but not be limited to the following functions: mechanical cooling, heating, active dehumidification, and total energy recovery.

3.6.5 AIR DISTRIBUTION SYSTEMS

The Contractor shall provide air distribution systems, including ducts, elbows, transitions, offsets, branch connections, and other construction fabricated of galvanized, sheet steel, in accordance with the Project Technical Requirements.

- Galvanized Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- Provide Stainless Steel ductwork for Truck Wash room and Train Wash bay areas.
- Static-Pressure Classifications: Provide low- medium- and high-pressure ducts conforming to WMATA design criteria.
- Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.
- Duct Accessories: Provide duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts.
- Duct Access Panels: Provide duct access panels for access to both sides of duct coils. Provide duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment unless note otherwise.
- Flexible Ducts: Comply with UL 181, Class 1. Flexible ducts longer than 5 feet are prohibited.
- Duct Insulation: All supply and outside air ductwork shall be insulated with material and thickness as required to comply with WMATA design criteria and to meet the minimum R-value per code. Insulation on the interior surfaces of ducts is prohibited.

a. Diffusers, Registers and Grilles.

- In acoustical tile ceilings provide square, full adjustable air pattern supply diffusers.
- At perimeters provide linear slot diffusers.
- Where air is to be distributed in high bay areas (20'+) provide high velocity drum type diffusers.

b. Air Filtration. Air filters shall be pleaded, replaceable-media high efficiency 4" filters. The Contractor shall provide DP gauges on either side of filtration rack to determine maintenance cycle from condition. Bag type filters are not permitted.

3.6.6 HVAC PERFORMANCE REQUIREMENTS

Table 3-1 lists the HVAC performance requirements for each of the buildings included in Package B. Unless noted otherwise, all stairs, rooms and spaces require the mechanical systems to provide A/C requirements of 72°F/50% RH, and heating requirements of 68°F at the seasonal ambient design temperatures.

Table 3-1. HVAC Performance Requirements

Room No	Room Description	A/C	Heat	Ventilation Notes	Remarks
S&I MAINTENANCE BUILDING					
001	Storeroom				
002	Elev. Equipment				See Note 1
003	Hoist Pits	None	None	Ventilate based on 10°F rise.	See Note 4
004	Fire Prot. Valve Room	None	50°F		
005	UPS	None	50°F /72°F	Continuous/calculated	
006	DC Switchboard Room	None	50°F /72°F	Calculated based on heat gain, minimum	See Note 3
007	AC Switchboard	None	50°F /72°F	Ventilate based on 10°F rise.	See Note 3
008	Wheel Truing Pit	None	65°F	8 air changes per hour	See Note 4
009	Blow Pit	None	65°F	8 air changes per hour	See Note 4
S1	Stair 1	None	70°F		
S2	Stair 2	78°F/50% RH	70°F		
101, 101A	Parts Room & Parts Counter	78°F/50% RH	70°F		
102	Storage			Air changesper hour based on type of storage and code requirements.	
103	Parts Receiving	78°F/50% RH	70°F		
108	Lobby	72°F/50% RH	70°F		
109	Elev. Equipment				See Note 1
110	Storage	None	65°F	Air changesper hour based on type of storage and code requirements.	
C1A	Corridor	72°F/50% RH	70°F		
111	Men’s Room	78°F/70% RH	70°F		
112	Custodial	None	50°F		
113	Women’s Room	78°F/70% RH	70°F		
114	Tool	78°F/70% RH	70°F		
115	Super Office	78°F/70% RH	70°F		
116	Inspector Office	78°F/70% RH	70°F		
118	Elect Shop	78°F/50% RH	70°F		

Room No	Room Description	A/C	Heat	Ventilation Notes	Remarks
118A	Storage	None		Air changesper hour based on type of storage and code requirements.	
120	Lube/Comp Room	None	65°F	Ventilation based on 10°F rise.	See Note 3
121	Battery Room	None	65°F	Continuous, calculated	
122	Wheel Truing	None	65°F	15 air changes per hour	See Note 4
123	Wheel/Axle Shop	None	65°F	8 air changes per hour	See Note 4
125	HVAC Shop	None	65°F	8 air changes per hour	See Note 4
126	Machine Shop	None	70°F	8 air changes per hour	See Note 4
S3	Stair 3	78°F/50% RH	70°F		
140	Blow Down	None	65°F	8 air changes per hour	See Note 4
150	Maintenance	None	65°F	8 air changes per hour	See Note 4
151	Truck Wash	None	65°F	8 air changes per hour	See Note 4
160	Interior Cleaning	None	65°F	8 air changes per hour	See Note 4
MO1	Small Stores	78°F/50% RH	65°F		
MO2	Comm Room	78°F/50% RH	65°F		
MO3	Building Systems	None	65°F	Ventilation based on 10°F rise. 10 cfm/boiler HP minimum.	See Note 4
C2A	Corridor	78°F/50% RH	70°F		
204	Men’s Lockers	72°F/50% RH	70°F		
204A	Men’s Room	72°F/50% RH	70°F		
204B	Men’s Showers	72°F/50% RH	70°F		
205	Women’s Lockers	72°F/50% RH	70°F		
205A	Women’s Room	72°F/50% RH	70°F		
205B	Women’s Showers	72°F/50% RH	70°F		
206	Planning Engineer/QA Office	72°F/50% RH	70°F		
207	Lunch Room	72°F/50% RH	70°F		Provide CO2 Sensors
208	Training Room	72°F/50% RH	70°F		Provide CO2 Sensors
209	Building Services	72°F/50% RH	70°F		
210	Storage	None	65°F	Air changes per hour based on type of storage and code requirements.	
211	TCR	72°F/50% RH	68°F		See Note 2

Room No	Room Description	A/C	Heat	Ventilation Notes	Remarks
212	Central Comm Room	72°F/50% RH	68°F		
213	Yard Control Tower	72°F/50% RH	70°F		
213A	Restroom	72°F/50% RH	70°F		
214	Conference Room	72°F/50% RH	70°F		Provide CO2 Sensors
215	Jan Room	None	50°F	Air changes per hour based on type of storage and code requirements.	
216	Unassigned Room	72°F/50% RH	70°F		
217	Unassigned Room	72°F/50% RH	70°F		
TRAIN WASH BUILDING					
101	Train Wash	None	65°F	4 air changes per hour (low speed) 8 air changes per hour (high speed)	See Note 4
102	Equipment	None	65°F	4 air changes per hour (low speed) 8 air changes per hour (high speed)	See Note 4
MOW BUILDING					
101	Lobby	78°F/50% RH	70°F		
102	Elev Equip				See Note 1
103	Storage	72°F/50% RH	70°F	Air changes per hour based on type of storage and code requirements.	
104	GMAC Shop	78°F/50% RH	70°F		
105	Power Mat Stor	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
106	Comm Repair and Stor	72°F/50% RH	70°F	Air changes per hour based on type of storage and code requirements.	
107	AC Switchboard Room	None	50°F	Ventilation based on 10°F rise.	See Note 3
108	UPS Room	None	77°F	Continuous/calculated.	
109	Comm Room	78°F/50% RH	65°F		
110 113	ATC Mat Stor	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
111	Plant Mat Stor	None	65°F	Air changes per hour based on type of storage and	See Note 4

Room No	Room Description	A/C	Heat	Ventilation Notes	Remarks
				code requirements.	
112	Plant Shop	78°F/50% RH	70°F		
120A	Future PLNT Storage at Mezzanine	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
120	Struct Mat Stor	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
113	ATC Mat Stor	78°F/50% RH	70°F		
114	Women's Room	72°F/50% RH	70°F		
115	Custodial	None	50°F		
116	Men's Room	72°F/50% RH	70°F		
117	TSSM Comm	72°F/50% RH	70°F		
118	TSSM Power	72°F/50% RH	70°F		
119	TSSM Sto	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
120	Structural Material Storage at Mezzanine	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
121	TSSM AFC	72°F/50% RH	70°F		
122	TSSM AFC	72°F/50% RH	70°F		
123	Track Mat Stor @ Mezzanine	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
124	Mech Room	None	65°F	Ventilation based on 10°F rise. 10 CFM/boiler HP minimum	See Note 4
125	Radio Comm	72°F/50% RH	70°F		
126	TRST Shop	None	65°F	8 air changes per hour	See Note 4
127	CTEM Repair Bays	None	65°F	8 air changes per hour	See Notes 4 & 5
127A	CTEM Shop / Storage	None	65°F	8 air changes per hour	See Note 4
128	Tools	78°F/70% RH	70°F		
129	Supv	72°F/50% RH	70°F		
130	Supv	72°F/50% RH	70°F		
131	CTEM Stor	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
132	Comp/Lube Room	78°F/50% RH	65°F	8 air changes per hour	See Note 4

Room No	Room Description	A/C	Heat	Ventilation Notes	Remarks
S1	Stair 1	78°F/70% RH	70°F		
S2	Stair 2	78°F/70% RH	70°F		
C1A thru E	Corridors	78°F/70% RH	70°F		
203	Training	72°F/50% RH	70°F		Provide CO2 Sensors
204	System Maint Offices	72°F/70% RH	70°F		
205	Plant Maint Offices	72°F/70% RH	70°F		
206	Men's Lockers	72°F/70% RH	70°F		
206A	Men's Room	72°F/70% RH	70°F		
206B	Men's Showers	72°F/70% RH	70°F		
208	Women's Lockers	72°F/70% RH	70°F		
208A	Women's Room	72°F/70% RH	70°F		
208B	Women's Showers	72°F/70% RH	70°F		
209	Office / Storage	72°F/50% RH	70°F	Air changes per hour based on type of storage and code requirements.	
210	Vend/Kitchen/Lunch Room	72°F/50% RH	70°F		Provide CO2 Sensors
211	TRST Offices	72°F/70% RH	70°F		
212	Conf Room	72°F/50% RH	70°F		Provide CO2 Sensors
214	Custodial	None	50°F		
C2 A thru E	Corridors	78°F/50% RH	70°F		
WAREHOUSE BUILDING					
101	Warehouse	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
102	Shipping/Receiving	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
103A	Control Office	72°F/70% RH	70°F		
103B	Receiving Office	72°F/70% RH	70°F		
103C	Break Room	72°F/70% RH	70°F		
103D	Men's Room	72°F/70% RH	70°F		
103E	Women's Office	72°F/70% RH	70°F		
103F	Janitor	None	50°F	Air changes per hour based on type of storage and code requirements.	See Note 4

Room No	Room Description	A/C	Heat	Ventilation Notes	Remarks
104	Paint Room	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
105	Fire Prot. Valve Room	None	50°F		
201	Mezzanine	None	65°F	6 air changes per hour	See Note 4
VEHICLE STORAGE BUILDING					
101	Vehicle Storage	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
102	Vehicle Storage	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
TRANSPORTATION/POLICE BUILDING					
101	Lobby	78°F/50% RH	70°F		
102	Lunch/Break Room	72°F/50% RH	70°F		
103	Unassigned Room	72°F/50% RH	70°F		
104	Custodial	None	50°F		
105	Training Stor	72°F/50% RH	70°F	Air changes per hour based on type of storage and code requirements.	
106	Office	72°F/50% RH	70°F		
107	Women's Lockers	72°F/50% RH	70°F		
108	Men's Lockers	72°F/50% RH	70°F		
109	Training Room	72°F/50% RH	70°F		Provide CO2 Sensors
110	Women's Room	72°F/50% RH	70°F		
111	Men's Room	72°F/50% RH	70°F		
112	Elev Equip				See Note 1
113	Storage	72°F/50% RH	70°F	Air changes per hour based on type of storage and code requirements.	
114	Elev Lobby	72°F/50% RH	70°F		
115	Yard Equipment Room	72°F/50% RH	70°F		
116	Conference Room	72°F/50% RH	70°F		Provide CO2 Sensors
117	Waiting room	72°F/50% RH	70°F		
118	Reporting Office	72°F/50% RH	70°F		
119	Office	72°F/50% RH	70°F		

Room No	Room Description	A/C	Heat	Ventilation Notes	Remarks
120	Office	72°F/50% RH	70°F		
121	Copy Room	72°F/50% RH	70°F		
122 thru 125	Office	72°F/50% RH	70°F		
126	Mechanical Room	78°F/50% RH	70°F		
127	Storage	72°F/50% RH	70°F	Air changes per hour based on type of storage and code requirements.	
128	Clean Room	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
129	Comm Room	72°F/50% RH	70°F		
130	General Storage	78°F/50% RH	70°F		
131	Conf Room	72°F/50% RH	70°F		Provide CO2 Sensors
S1	Stair 1	78°F/50% RH	70°F		
S2	Stair 2	78°F/50% RH	70°F		
C1	Corridor	78°F/50% RH	70°F		
C2A	Corridor	78°F/50% RH	70°F		
201	Break Room	72°F/50% RH	70°F		
202	Gym Room	72°F/50% RH	70°F		
203	Bunk Room	72°F/50% RH	70°F		
204	General Storage	72°F/50%RH	70°F	Air changes per hour based on type of storage and code requirements.	
205	Women's Lockers/Showers	72°F/50% RH	70°F		
206	Women's Room	72°F/50% RH	70°F		
207	Men's Lockers/Showers	72°F/50% RH	70°F		
208	Men's Room	72°F/50% RH	70°F		
209	Defensive Training Room	72°F/50%RH	70°F		Provide CO2 sensors
210	Crime Scene Search Office	72°F/50% RH	70°F		
211	Evidence Storage	72°F/50%RH	70°F	Air changes per hour based on type of storage and code requirements.	
212	Crime Gear Storage	72°F/50%RH	70°F	Air changes per hour based on type of storage and code requirements.	

Room No	Room Description	A/C	Heat	Ventilation Notes	Remarks
213	Server Room	72°F/50% RH	70°F		
214	Janitor Room	None	50°F	Air changes per hour based on type of storage and code requirements.	See Note 4
215	Men's Room	72°F/50% RH	70°F		
216	Reception	72°F/50% RH	70°F		
217	Women's Room	72°F/50% RH	70°F		
218	Weapon safe	72°F/50% RH	70°F		
219	Storage	72°F/50%RH	70°F	Air changes per hour based on type of storage and code requirements.	
220	Roll Call Room	72°F/50%RH	70°F		Provide CO2 sensors
221	Crime Scene Work Area	None	65°F	Air changes per hour based on type of storage and code requirements.	See Note 4
222	Training Storage	72°F/50%RH	70°F	Air changes per hour based on type of storage and code requirements.	
223	Training Room	72°F/50%RH	70°F		Provide CO2 sensors
224	Storage	72°F/50%RH	70°F	Air changes per hour based on type of storage and code requirements.	
225	Office	72°F/50% RH	70°F		
226	Sergeant's Offices	72°F/50% RH	70°F		
227	Interview Room	72°F/50% RH	70°F		
228	Office	72°F/50% RH	70°F		
229	Office	72°F/50% RH	70°F		
230	Detective's Office	72°F/50% RH	70°F		
231	Captain's Office	72°F/50% RH	70°F		
232	Conf Room	72°F/50% RH	70°F		Provide CO2 Sensors

Notes:

1. See Section 3.6.7.2 regarding Elevator Machine Rooms.
2. Any HVAC equipment serving this space shall be accessible outside of the room itself.
3. The ventilation fan(s) shall operate by thermostat when the room temperature rises above 90°F.
4. The ventilation fan(s) shall operate by thermostat when the room temperature rises above 85°F.
5. Provide ductwork and exhaust fan as required for extraction arm device.

3.6.7 ADDITIONAL MECHANICAL REQUIREMENTS

3.6.7.1 VIBRATION ISOLATION

a. Vibration Isolation. Equipment producing vibrations shall be isolated from the structure by spring or rubber-in-shear vibration isolators per the Requirements of the Project Technical Requirements. All pipe and ducts connected to equipment mounted on vibration isolators shall contain flexible connections or provisions made for vibration isolating type supports. Identify on drawings where vibration isolators are to be provided.

b. Equipment Mountings. Equipment to be mounted on the floor shall be placed on reinforced concrete housekeeping pads. Minimum pad height shall be six inches; all equipment to be suspended from ceiling shall be provided with suspension type hangers consisting of combination of spring and neoprene in series.

3.6.7.2 ELEVATOR MACHINE ROOM

a. The purpose of temperature control in the Machine Room is to prevent equipment shutdown due to over-cooling or over-heating. Minimum requirements are contained in the WMATA Design Criteria.

b. The temperature shall be a minimum of 50°F. No heat is required in underground machine rooms. Where heat is provided, temperature controls shall be automatic, turning on at 50°F DB and off at 55°F DB. Exhaust ventilation shall be based on a capacity of one hundred (100) cfm per driving machine motor horsepower. Exhaust fans shall be automatically controlled, turning on at 90°F DB and off at 85°F DB.

c. Machine room ventilation ducting passing through adjacent occupied areas shall be protected with a two-hour (higher if the category of the area required) fire-rated construction. The ventilation fan shall be located in the machine room and shall discharge outdoors through the exhaust opening or ducting. Minimum head room clearance of 7’-0” shall be provided under the fan and ductwork. Where possible, the supply and exhaust ventilation system for the machine room shall be free of obstructions except for necessary grilles, screens or dampers. Fire dampers shall be provided at pierce points (openings) in the machine room walls, floor or ceilings.

d. No water piping or other non-elevator related services shall be allowed to run in any elevator machine rooms.

e. Where adequate make-up air is unavailable, utilize an air terminal unit, fan coil unit, or split system to provide temperature control for Machine Room. All air shall be re-circulated within the Machine Room.

3.6.7.3 CLEARANCE TO INSTALLATIONS

A minimum of two inches is required between any fixed installations (e.g. pipes, pipe hangers, pipe supports, signals, lighting fixtures, etc.) and the design vehicle dynamic outline.

Installations shall be so dimensioned and located that maximal distances are obtained between these and clearance envelope along tangent and curved alignments.

3.6.7.4 MAINTAINABILITY AND CONSTRUCTABILITY

a. The design of mechanical systems and equipment installations shall be coordinated with structural, electrical, architectural and other disciplines for the purpose of insuring adequate space, clearances, structural support, and non-interference with other trades during construction. Designs shall take ease of mechanical equipment maintenance into account. Maintenance operations will include inspection, adjustments, cleaning, trouble shooting, servicing, repairs and replacement of mechanical equipment. The selected equipment shall be subject to minimal system component failure.

b. Sufficient working space and adequate access shall be provided for the maintenance and replacement of all mechanical equipment. This requirement shall include adequate space for movement of equipment during initial installation, and during subsequent unscheduled maintenance involving removal and replacement of failed equipment.

c. Provide not less than the manufacturer's recommended service clearance plus clearance for circulation and placement of ladders, tools and other required auxiliary maintenance equipment.

d. Mechanical system designs shall be in accordance with the following requirements:

   - Chain operators shall be provided for chilled and condenser water valves mounted 8 feet or more above the finish floor.
   - Chiller and boiler tube pull spaces shall be indicated on the drawings.
   - Filter pull spaces shall be indicated on the drawings.
   - Coil pull spaces shall be indicated on the drawings.
   - Special requirements (e.g. cooling tower drive shaft pull space) shall be considered and called out on the drawings as required.

e. Equipment shall not be suspended over floor mounted equipment or pits in a manner which prevents access to the suspended unit.

3.6.7.5 HVAC INSTRUMENTATION AND CONTROLS

The Contractor shall provide a Building Automation System: Provide a Building Automation System (BAS) based on a distributive type Direct Digital Control (DDC) in accordance with the Project Technical Requirements.

3.6.7.6 TESTING, ADJUSTING AND BALANCING

The Contractor shall perform testing, adjusting and balancing In accordance with the Project Technical Requirements and the following subsections.

a. Air and Piping System Testing, Adjusting and Balancing.

b. Provide balancing devices, such as test ports, flow-control devices, balancing valves and fittings, and manual volume dampers, to properly balance the systems. Provide acceptable quantities and in proper accessible locations of these balancing devices for effective balancing and for efficient system and equipment operation.

   - Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or AABC's "National Standards for Testing and Balancing Heating, Ventilation, and Air Conditioning Systems".
   - Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

3.6.8 PLUMBING

3.6.8.1 PLUMBING FIXTURES

The Contractor shall provide all plumbing fixtures shall be in accordance with the Project Technical Requirements and as noted herein.

- All plumbing fixtures, where applicable, shall be of a water saving design.
- Stainless steel industrial shop hand washing stations shall be provided in shop areas with physical lever valves.
- Trap primers shall be used as required by local codes and shall be installed on lines with consideration to the frequency of operation.
- Exterior hose bibs shall be key-type with freeze protection.
- Provide 3/4" water hose bib with standard faucet mounted in accordance with ADA requirements. AFF between bay doors (1 per 3 bays) at vehicle repair bays.
- Provide instantaneous electric water heaters for remote restroom facilities without showers.
- All janitor and custodial rooms shall have floor mounted mop basin with bucket holding supported spout and short flexible hose connection and rack for storing mops.
- Provide all water supplies with key operated service valves.

a. Water Closets. Provide wall-hung Low-Flush water closets with sensor-operated electronic flushometers throughout the facility in sufficient quantity to serve occupant load. Sensor-operated fixtures shall be hard wired and not battery operated.

b. Urinals. Provide wall-hung Low Flow urinals with sensor operated electronic flushometers in all men's rooms in sufficient quantity to serve occupant load. Sensor-operated fixtures shall be hard wired and not battery operated.

c. Lavatories. Provide wall hung lavatories in locker room areas and countertop mounted lavatories in staff and general toilet rooms. Sensor operated electronic faucets shall be installed for washing hands.

d. Sinks. Provide stainless steel countertop sinks in kitchen, lunch and break rooms.

e. Service Sinks. Provide stainless steel service sinks in the Maintenance area and Service Lanes. Provide a minimum of one service sink in the Service Lanes and two in the Maintenance area (on opposite ends.) Service sinks shall have a minimum of 11" deep bowl.

f. Basins. Provide mop basin and mop rack in each janitor's closet.

g. Water Coolers. Provide wall hung electric bi-level water coolers with bottle filler in each locker room, maintenance area, and outside of grouped staff toilet rooms, with accessibility compliance.

h. Showers. Provide single lever shower faucet and shower head (accessible hardware required in accessible showers). Showers for men and women shall be individual type.

i. Emergency Eyewash and Body Spray Units. Provide in accordance with OSHA (ANSI Z358.1-2009) and applicable code requirements. Provide tempered water at the proper volume and temperature, and for the duration necessary to meet OSHA requirements. Provide combination units in the Maintenance Repair Bays, Chassis Wash, Lube/Compressor Room, Service Lanes, and Battery Storage Area. Provide eyewash units in rooms where hydraulic lift pumps are located and other areas where the potential for eye damage exists and as required by code.

3.6.8.2 DOMESTIC WATER DISTRIBUTION SYSTEM

The domestic water distribution consists of the following elements: Piping, Piping Specialties, Valves, Meters and Gauges, and Insulation.

a. Water Service.

- Provide a domestic cold, hot and hot water recirculating water distribution system without supply interruptions per Project Technical Requirements and as required herein.
- A Reduced Pressure Backflow Preventer shall be provided for the building water service.
- Shutoff valve, hose-end drain valve, strainer, pressure gauge, and test tee with valve, shall be inside building at each domestic water service.
- Provide cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight.
- Provide domestic water heater(s) with adequate capacity for serving showers and sinks.
- Provide service valves to separately shut off each fixture, each toilet group each wing or functional area of the building, and each building.

b. Piping.

- Hot, Cold and Recirculation Water Piping 2 1/2” and Smaller: Aboveground, shall be ASTM B 88, Type L drawn-temper copper tubing with soldered joints. Below ground or within slabs, provide ASTM B 88, Type K annealed-temper copper tubing with soldered joints. Use the fewest possible joints below ground and within slabs.
- Hot, Cold and recirculation Water Piping 3” and Larger: Provide ASTM A 53/A 53M, Type S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.

c. Piping Specialties.

- Hammer Arrestors: Install Hammer Arrestors, also known as shock absorbers, on the cold and hot water distribution systems, where the action of quick operating valves could result in a water hammer condition.
- Hose Bibs/Hydrants: Provide hose bibs/hydrants, on the interior perimeter of the Maintenance Area and Service Lanes every 100 feet. Freeze proof wall hydrants shall be provided every 200 feet around the perimeter of the Maintenance/Office building(s).
- Provide Reduced Pressure Backflow Preventors (RPBP) for incoming domestic water supplies, train washer, boiler or where the water supply may be as risk of contamination.
- Pressure reducing valves shall be provided where water pressure is above 60 psi in the water service room.
- Dielectric Fittings: Install dielectric fittings for pipe connections where there are dissimilar metals.

d. Valves.

- Shutoff Duty: Use bronze ball valves for piping NPS 3 and smaller. Use cast-iron gate valves with flanged ends for piping NPS 4 and larger.
- Throttling Duty: Use bronze ball valves or butterfly valves for piping NPS 3 and smaller. Use cast-iron globe or gate valves with flanged ends for piping NPS 4 and larger.
- Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
- Drain Duty: Hose-end drain valves.
- Provide sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball valves for piping NPS 3 and smaller. Use gate valves for piping NPS 4 and larger.
- Provide shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball valves for piping NPS 3 and smaller. Use gate valves for piping NPS 4 and larger.
- Provide drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
- Provide hose-end drain valves at low points in water mains, risers, and branches.
- Provide calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow.

e. Piping Insulation.

- Provide closed-cell foam pipe insulation thickness as required by code.
- Provide minimum ½" thick insulation on cold water piping.
- Provide vapor retarder on all piping subject to water temperatures below 70°F.
- Provide heavy PVC fitting covers on all fittings.

- Provide PVC jacket on all piping installed in the Service Lanes.
- Provide insulation on all piping subject to condensation formation.

f. Cleaning. Clean and disinfect potable domestic water piping. Disinfect and purge the water supply as prescribed by the AHJ prior to use. Procedures shall be at least equivalent to either AWWA C651 or AWWA C652.

3.6.8.3 SANITARY WASTE SYSTEMS

- Sanitary waste systems shall be installed per the requirements of the Project Technical Requirements and as stated herein.
- Drain trench grates shall be supported by steel nosing embedded in the concrete drain trenches. The trench drains shall be sloped at not less than 1/8" per foot. The trench drains shall be not less than 12" wide with flat bottom to allow cleaning with a shovel and the grating shall accommodate H-20 loading.
- Drains in lubricant containment areas shall be the type which are manually operated and shall normally be closed except during wash down.
- Some areas such as lift pits, chassis wash and train wash areas require special drains, trenches, trench depths and widths, traps, and sumps. These components shall be identified and coordinated prior to design package submission.
- Provide floor drains at all equipment having condensate drains, including air compressors, refrigerated air dryers, and other mechanical equipment.
- Provide drainage at and below all train turntables, train hoist and vehicle washing equipment.
- Minimum pipe size used underground shall be 3".
- Provide cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall.

a. Cleanouts.

- Provide cleanouts at all changes in direction of 45° or greater, every 50 feet on piping 4" and less, and every 100 feet for piping over 4".
- Provide cleanouts at the base of all risers.
- Provide wall cleanouts at gang toilets.

b. Drains.

- Provide pipe and fittings for two drainage systems. One drainage system shall be for oily waste and one drainage system shall be for sanitary waste.
- All floor drainage systems shall be coordinated with the under floor building elements shall be distinguished between sanitary and oily waste. All floor drainage from the maintenance and wash lane areas which have vehicular traffic termed (oily waste) shall be piped to the oil water separation system.

- All floor drains shall be installed with trap primers. Electronic trap primers shall be provided where water supply is not based on operation of toilet fixture flush valves. Their location shall be noted on the drawing.
- Train Wash Area: Provide a longitudinal trench drain along the entire length of the train washers, including the blower/dryer assembly (if included), and shall be centered in the train wash lane. Each trench drain shall be pitched to accommodate the Wash Water Reclamation system and shall terminate with a sediment trap. The trench drains shall be sloped at not less than 1/8" per foot. The trench drains shall be not less than 12" wide with flat bottom to allow cleaning with a shovel and the grating shall accommodate H-20 loading. Drainage from the train wash (oily waste) shall be piped to the oil water separation system.
- Maintenance Bays and Service Lanes Areas: Provide trench drains across the entrance and exits to these areas and be located within two feet from the face of the overhead doors. The trench drains shall be pitched to allow efficient flow of water and terminate with a sediment trap. The trench drains shall be not less than 12" wide with flat bottom to allow cleaning with a shovel and the grating shall accommodate H-20 loading.
- Vehicle Storage: Provide trench drains across the entrance and exits to these areas and be located approximately 5' inside the entrance and inside exits. The trench drains shall be pitched to allow efficient flow of water and terminate with a sediment trap. The trench drains shall be not less than 12" wide with flat bottom to allow cleaning with a shovel and the grating shall accommodate H-20 loading. In addition to the trench drains, provide additional 24" x 24" square heavy duty parking area catch basins accommodating an H-20 loading throughout the parking areas to provide adequate drainage. Trench drains running parallel to the direction of vehicle parking may be used in lieu of the catch basins. Trench drains shall not be less than 12" wide to allow cleaning with a shovel and the grating shall accommodate H-20 loading.
- Miscellaneous Areas:
- Toilet Rooms: Provide at least one floor drain in each room.
- Shower Rooms: Provide quantity and type required for adequate drainage.
- Emergency Eyewash Body Spray Units: Provide a floor drain at each location.
- Mechanical/Electrical and Compressor Rooms. Provide a minimum of one floor drain in each mechanical/electrical and compressor room. Provide additional floor drains where required to eliminate horizontal drainage piping from equipment exceeding 10 feet.
- Shops and Parts Storage: Provide a minimum of one floor drain in each shop and parts storage area
- Sprinkler Room: Provide area drain for sprinkler system

c. Oil/Water Separators.

- Provide an oil/water separator as part of the drainage system for drainage from shop areas, fuel lanes, vehicle wash overflow, and as required by code. The oil/water separator shall be capable of storing the petroleum product typically seen in similar applications. The separator shall be designed based on American Petroleum Institute

(API) standards, a maximum horizontal velocity of 3 fpm, a maximum depth-to-width ratio of 0.5, and continuous flow operation. The separator shall be additionally designed based on local, state and federal requirements. The local sewer district shall be contacted to determine if there are specific requirements and discharge limits.

- The oil water separator shall be designed with: a sediment trap; remote holding tank; a H-20 loading capability including manways; venting; oil removal tubes; manways, cleanouts on the inlet and outlet ends of the system and applicable features necessary for the use and installation requirements where it will be installed.
- Oil/water Separator shall not require cathodic protection and have a minimum 30 year product life service warranty.
- Monitoring system shall include but not limited to level detection, audible alarm at 85% filled capacity, wiring and conduit from monitoring panel to oil water separator and an approved local agency for removal of contained petroleum products in the separator.

3.6.8.4 STORM WATER DRAINAGE SYSTEMS

- Provide building drainage systems for rain (storm) water drainage in accordance with the requirements of the Project Technical Requirements.
- Provide ½" thick insulation with vapor retarder on roof drain bodies and horizontal leaders inside the facility.

3.6.8.5 NATURAL GAS SYSTEMS

- Drips and Sediment Traps: Provide drips at connections to equipment and other points where condensate may collect and at the outlet of service meters. Locate where readily accessible for cleaning and emptying. Do not install where condensate would be subject to freezing.
- Provide unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required on flanged devices.
- Provide shutoff valves at each piece of equipment. Locate shutoff valve upstream of drip and sediment traps.
- Provide vent piping for gas pressure regulators and gas trains, extend outside building, and vent to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end.
- Provide containment conduits for gas piping below slabs, within building, in gastight conduits extending minimum of 4″ outside building, and vented to atmosphere. Terminate vents with turned-down, reducing-elbow fittings with corrosion-resistant insect screens in large end. Prepare and paint outside of conduits with coal-tar, epoxy-polyamide paint according to SSPC-Paint 16.
- Prepare and paint exterior gas piping and gas piping located in the Maintenance Area and Service Lanes with high performance coating.

3.6.8.6 COMPRESSED AIR SYSTEM

The Contractor shall provide a compressed air system per the requirements of the Project Technical Requirements. Compressed air quality and quantity shall be compatible with requirements for shop tool and equipment operation, including pneumatic engine starters, and tire pressurization. Provide very dry compressed air suitable in quality, quantity, and pressure for the Brake Test air system.

a. Compressor.

- Provide air compressors, each shall be sized based on a 50% diversity factor at 125 psig for Shop air. Provide intake filtration, cylinder unloading, automatic blow-down, and after cooler
- Provide air compressors, each shall be sized based on a 50% diversity factor at 175 psig for Brake Test air. Provide intake filtration, cylinder unloading, automatic blow-down, and after cooler.
- General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors that deliver air of quality equal to intake air.

b. Dryer.

- Provide thee mechanical compressed air dryers to meet 100% of the anticipated load. The dryers shall be each capable of delivering compressed air with a dew point of 28 degrees F.
- Provide two refrigerated air dryers for the Shop air system.
- Provide one twin tower desiccant dryer for the Brake Test air system.
- Brake Test air shall be very dry.

c. Receivers.

- Provide steel tank receivers constructed according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- Pressure Rating: Minimum rating shall be equal to the highest discharge pressure of connected compressors, and bearing appropriate code symbols.
- Interior Finish: Corrosion-resistant coating.
- Accessories: Include safety valve, pressure gage, drain, and pressure-reducing valve.
- The compressed air system shall have adequately sized air receivers located in the compressor room. The receivers shall have automatic drains set at the appropriate pressure.
- A separator and filter shall be mounted between the air receiver and the air dryer.
- Brake Test compressed air line shall receive two additional inline filtered dryers prior to the dryer and one filtered dryer after the desiccant dryer prior to distribution.

d. Piping.

- The overhead compressed air piping system shall be designed based on a working pressure of 150 psig for the shops air system.
- The overhead compressed air piping system shall be designed based on a working pressure of 200 psig for the Brake Test air system
- The compressed air mains shall be sized based on a 50% diversity factor.
- Provide air outlets as shown on indicative equipment layout drawing. Coordinate location of outlets with Airports Authority.
- Provide air outlets throughout the train storage area conveniently accessible to each parked train. The intent is not to have an outlet for each train. Coordinate location of outlets with Airports Authority.
- Compressed air drops shall consist of the following components: ball cut-off valve, filter, regulator with gauge, lubricator, 1/4 inch quick disconnect, and a 6 inch drip leg with ball valve. Compressed air outlets shall be mounted 42 inches above finished floor, except those on trapezes.
- All branch lines for the compressed air header shall exit from the top of the header, except drip legs to condensate drain traps shall exit from the bottom.
- All lines, including main header, shall be sloped to drain to drip legs with condensate drain traps.
- All valves in the compressed air system shall be of the ball-type.
- Branch piping shall be no less than 3/4" diameter. The size of the branch piping shall be based on most demanding device being served. Each branch shall be furnished with a filter/regulator/lubricator and an isolation valve at the branch/ main takeoff.

e. Piping Specialties.

- Provide thermometer and pressure gage on discharge piping from each air compressor and on each receiver.
- Provide safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- Provide air-main pressure regulators in compressed-air piping at or near air compressors.
- Provide air-line pressure regulators in branch piping to equipment and tools. Regulators shall be sized for flow with minimal pressure drop. Regulators shall be sized for a capacity 1.5 to 2 times the allotted line pressure.
- Provide automatic drain valves on after-coolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
- Provide coalescing filters in compressed-air piping at or near air compressors.
- Provide air-line lubricators in branch piping to equipment and tools.
- Provide quick couplings at piping terminals for hose connections.

- Provide hose reel assemblies per Project Technical Requirements at hose connections.

3.6.8.7 MAINTENANCE FLUID SYSTEMS

The Contractor shall provide maintenance fluid systems in accordance with the Project Technical requirements and the following subsections.

- No piping which contains soil contaminating fluids shall be direct buried in earth. Piping which is required to communicate with services across floors and vehicle traffic areas shall be routed in trenches as described in the structural section. All piping shall be readily accessible and available for visual inspection. The Contractor shall coordinate the trench width and turning area requirements and allowance shall be provided for wrench clearances between fittings and pipes where appropriate or necessary for safe maintenance practices. The methods of supporting pipes shall be detailed along with their arrangement and routing.
- Piping supports shall provide a 20% load contingency for the addition of future services and piping. Each plumbed system shall have shut-off valves overhead. All piping sizes shall be based on maximum expected flows with an appropriate fouling allowance.

a. Fluid Tanks. Provide tanks and drums as specified, required and as shown on the Project Technical Requirements.

- Provide Tanks that are double wall construction and provide liquid level indicators.
- Provide Tanks and Drums fully filled with designated fluid and tested for proper operation.

b. Pumps.

- Provide air piston pumps for Engine Oil. Pumps shall be 3 inch, 5:1 ratio. Service fluid shutoff valve of 2000 psig.
- Provide air piston pumps for Chassis Grease. Pumps shall have a service fluid shutoff valve at 6000 psig. Ratio 50:1
- Provide piping and switching between equipment and utilities.
- Priming piston: Pump shall have priming piston and priming tube.
- Double acting: Pump shall provide equal delivery of material on up and down strokes.
- Variable volume: Pump shall adjust speed to match system demands.
- Adjustable throat packing: Pump shall have adjustable throat packing nut.
- Elevator: Pump shall be provided with baseplate mounted, air operated elevator to support pump and inductor plate.
- Inductor plate: Pump shall have inductor plate rigidly mounted to end of pump tube and rubber wiper shall be attached to inductor plate to clean drum.

- Provide noncorrosive nameplate showing product, manufacturers name, model number and pertinent utility operating data.
- Mounting Method: Pump shall be wall mounted and configured to draw from a 55-gallon drum.
- Acceptable manufactures shall be Graco, Lincoln or Ingersoll Rand.
- Available air supply shall be 100 PSI, 18 CFM

c. In-Line Direct Read Meters.

- Provide direct read analog totalizing meters in tank room on outlet of pumps for branch piping for each fluid
- Provide direct read LCD dispenser nozzles.
- Provide the following piping materials for fluid/service from the storage tanks/drums to the dispenser reels.
- Gear Oil - Steel Tubing
- Glycol - Copper Tubing
- Grease - Steel Tubing

d. Hose Reels, Hoses and Nozzles.

- Provide tanks and drums as specified.
- Provide professional level hose reels in accordance with the Project Technical Requirements and as noted below. Reel shall have a double pedestal frame, metal spool non-sparking ratchet
- Air motor: Differential air motor powered by compressed air shall drive piston up and down inside cylinder to draw material in through pump intake and force it out pump outlet.
- In-line design: Air motor, air motor valves, and lower pump shall be of the in-line design and air motor shall be balanced with no metal to metal seals.
- Air valve: Pump shall have pneumatically actuated air valve.
- Construction: Frames, discs, and drum shall be fabricated of high-strength steel
- Double pedestal arm: Reel frame shall have double pedestal arms that are welded and gusseted.
- Hose guide arm: Reel hose guide arm shall be adjustable with nylon rollers on all four sides of roller assembly at hose opening.
- Rewind mechanism: Reel spring shall be enclosed and fastened to reel drum with a reinforcing clip.
- Bearings and ratchet latch: Reel shall have permanently lubricated bearings and extra large ratchet latch with audible hose position lock.
- Double acting: Pump shall provide equal delivery of material on up and down strokes.

- Variable volume: Pump shall adjust speed to match system demands
- Hose covers and tubes: Chassis grease hose shall have Buna-N tube and Buna-N PVC cover. All other commodity hoses shall have Buna-N nitrile tube with nitrile PVC cover
- Provide length of hose with inside of ½ inch at approximately 50 feet.
- Provide process piping from product pumps to point of connection for each reel specified herein.
- Identification labels: Each commodity reel shall have a 3/4 by 4-1/4 inch metal identification label indicating the commodity, attached adjacent to each hose guide arm roller assembly. Label kits including label and mounting hardware as listed for each commodity.

3.6.8.8 GLYCOL FLUID SYSTEMS

The Contractor shall provide glycol fluid systems in accordance with the Project Technical requirements and the following subsections.

a. Fluid Tanks.

- Provide two 2,500 gallon double-wall aboveground polyethylene tanks in accordance with the Project Technical Requirements.
- Provide above-ground tank that is double wall construction and contains liquid level indicators.
- Primary tank of the double wall tanks is completely contained. Double wall tanks shall be designed for outdoor applications. Enclosed design of our double wall tanks shall prevent rain, snow and debris from collecting in containment tank. The outer tank wall shall be translucent.
- Provide vented, hinged manway in tank 12” minimum diameter.
- Provide tank fully filled with designated fluid and tested for proper operation.
- Provide concrete pad to house storage tank.

b. Pumps.

- Provide air piston pumps for Glycol. Pumps shall have a service fluid shutoff valve at 200 psig.
- Provide piping and switching between equipment.
- Provide noncorrosive nameplate showing product, manufacturers name, model number and pertinent utility operating data.
- Mounting Method: Pump shall be ceiling truss or wall mounted and configured to draw from a 2,500-gallon container.
- Provide reel for dispensing.

c. Piping Materials.

- Hard Copper Tube: ASTM B 88, Type L, water tube, annealed temper with copper pressure fittings: ASME B 16.18, cast-copper-alloy or ASME B 16.22, wrought-copper, solder-joint fittings.

d. Hose Reel.

- Provide professional level hose reels designed for frequent everyday use in wide variety of applications. Reel shall have a double pedestal frame, metal spool non-sparking ratchet
- Air motor: Differential air motor powered by compressed air shall drive piston up and down inside cylinder to draw material in through pump intake and force it out pump outlet.
- In-line design: Air motor, air motor valves, and lower pump shall be of the in-line design and air motor shall be balanced with no metal to metal seals.
- Air valve: Pump shall have pneumatically actuated air valve.
- Construction: Frames, discs, and drum shall be fabricated of high-strength steel
- Double pedestal arm: Reel frame shall have double pedestal arms that are welded and gusseted.
- Hose guide arm: Reel hose guide arm shall be adjustable with nylon rollers on all four sides of roller assembly at hose opening.
- Rewind mechanism: Reel spring shall be enclosed and fastened to reel drum with a reinforcing clip.
- Bearing and ratchet latch: Reel shall have permanently lubricated bearings and extra large ratchet latch with audible hose position lock.
- Provide process piping from product pumps to point of connection for each reel specified herein.

3.6.8.9 USED OIL SYSTEM

The Contractor shall provide a used oil system in accordance with the Project Technical requirements and the following subsections.

a. Provide one 500 gallon and one 1,000 gallon waste oil tank. Primary and secondary tank shall be designed and constructed in accordance with Underwriters Laboratory, Inc. Standard UL 142. Tank shall meet all the requirements for atmospheric tanks of The National Fire Protection Association Sections 30, 30A, 31 and The Uniform Fire Code Article 79.

b. Primary tank shall be constructed of ASTM A-569 or A-36 carbon steel. Secondary Tank: Tank shall provide a minimum of 110% secondary containment and be equipped with a 2 inch monitoring port and a 4 inch or 6 inch emergency vent port as required by Underwriters Laboratory.

c. Factory Testing. Primary and secondary tanks shall be tested in the factory to the UL 142 specifications (3 to 5 PSI).

d. Fittings. Tank shall be provided with fittings for all openings.

e. Lifting Lugs. Tanks shall be equipped with lifting lugs.

f. Tank Label. Provide tank label with name of product to be stored in minimum 4 inch letters in easily readable location when tank is installed.

g. Accessories. Accessories for the tank shall consist of Tank gauge: Scully product level tank gauge, one each. Spill box: 7 gallon box-welded spill box, one each, Alarm: 2 inch Scully whistle vent alarm, one each, 6" fill standpipe with tank inlet spout adapter and dust cap. OPW 633AST, and 634B, or alternative. regular vent, one each, gauge opening, one each, manifold opening, two each, and monitor opening, one each, all per the manufacturers recommendations.

3.6.8.10 FUELING SYSTEM

The Contractor shall provide a fueling system in accordance with the Project Technical Requirements and the following subsections.

- Comply with EPA Regulations 40 CFR Part 280 and NFPA 30 and 30A.
- In addition to requirements herein, comply with requirements in the Project's Environmental Reports, Soil and Management Plans.
- See the Project Technical Requirements for locations of fuel tank tanks, level/gauging system, fuel monitoring system, fuel dispensers, submersible pumps and fuel gantry system.
- Provide a gravity oil/water separator (OWS) capable of holding 100 gallons of fuel for each fuel lane. A single OWS may be provided with the combined holding capacity for all of the connected fuel lanes.

a. Storage Tanks.

- Provide two 15,000 gallon double wall fiberglass underground fuel tanks complete with manholes, hold-down straps, lifting lugs and accessories. One tank shall be for diesel and one tank shall be used for unleaded gasoline.
- Provide tanks with a permanent stencil, label or plate as required by federal, state and local regulations and codes. Tanks shall bear UL label for underground installation and the specific product to be stored.
- Provide tanks warranted for 30 years against failure due to internal or external corrosion and structural failure.
- Provide tanks that withstand surface H-20 axle loads.
- Provide tanks capable of storing gasoline, gasohol 10% ethanol and 90% gasoline mixture, gasoline blends containing ethyl alcohol, methanol or other alcohol

compound, diesel fuel or fuel oil at ambient underground temperatures and shall be listed by UL for that purpose.

- Provide tanks with an interstitial space between the primary and secondary tanks filled with brine solution suitable for monitoring leaks.
- Provide a minimum of two monitoring wells in the backfill of each storage tank field. Provide additional monitoring wells as required by local ordinances. Provide vapor recovery system for gasoline dispenser.

b. Piping.

- Below ground piping: Polyethylene; UL 971 listed and labeled; multi-layer; nylon 12 pipe liner; braided fiber reinforcement; polyethylene cover; polyethylene containment jacket, carrier conduit or double wall fiberglass containment pipe using thermosetting resins. Slope piping to storage tank.
- Above ground piping: ASTM A 53, Type E or S, Grade B, Schedule 40, black with malleable-iron threaded fittings: ASME B16.3, Class 150, standard pattern, with threaded ends according to ASME B1.20.1.
- Prepare and paint any exposed fuel piping located in the service lanes with high performance coating in accordance with the Project Technical Requirements

c. Tank and Piping Leak Detection and Inventory Control System.

- Provide an inventory control system for the fuel storage tanks. The system shall include an indoor mounted electronic control panel with digital display and with remote tank sensors. The system shall be able to interface with the Fluid Monitoring System. Provide a leak detection system for the fuel storage tanks. The system shall include an indoor mounted control panel with alarm and remote tank sensors placed in the interstitial space between the primary and secondary tanks.
- Provide a leak detection system for the underground fuel piping system. The system shall include an indoor mounted control panel with alarm and remote piping sensor.

d. Fueling System Accessories.

- Provide penetrations for: Interstitial space monitoring, Tank fill (this manhole shall be a spill containment type), Tank level sensor for inventory control system, and tank suction line
- Provide discriminating sump sensor in the tank suction line manhole.

3.6.8.11 DIESEL FUEL DISPENSER (DUAL HOSE)

Diesel fuel dispenser system shall be in accordance with the Project Technical Requirements and following additional requirements:

a. Dispenser Capacities and Dimensions. Liquid control meter and high volume remote dispensing unit shall communicate with PC and card access fuel recording systems.

- Delivery Capacity: 22 GPM maximum.

- Working Pressure: 50 PSI maximum.
- Operating Temperature: -30 to 150 degrees Fahrenheit.
- Hoses: Length - 12 feet; Inside diameter – 1 inch.

b. Features and Construction.

- Cabinet construction: Dispenser cabinet shall have carbon steel top panel. Front, back and side panels shall be of hot-dipped galvanized steel with polycarbonate bezel. Unit shall have durable, scratch resistant, acrylic dial face graphic panel.
- Deadman timer circuitry: Microprocessor shall automatically be reset in the event a down condition is detected.
- No pulse timer: Timer shall automatically turn dispenser off if no pulse is detected for 255 seconds and shall turn off dispenser if both pulser channels fail.
- Interface board: Dispenser shall utilize a RS 485 module to transfer information to fuel management systems.
- Nozzle boot: Dispenser shall have front oriented nozzle boot for 1” high flow nozzle.
- Registers: Dispenser shall have 1 inch backlit LCD displays on front and back of cabinet. Registers shall be battery backed to protect against loss during power failure.
- Totalizer: Displayed on LCD by magnetic switch activation, up to 999999.
- Pulser: 0.1 gallon pulser integral with meter for interface with fuel recording system, one each.
- Solenoid valves Unit shall have two stage solenoid valves for accurate control of preset shut-off and flow control. It shall be pressure rated for system requirements, operate at 120 VAC, and factory installed as standard equipment.
- Meter: Dispenser shall have positive displacement three piston meter.
- DC Conduit: Dispenser shall include DC conduit and junction box in lower cabinet for wiring connections to fuel control systems.
- Strainer valve and filter: Dispenser shall have manufacturer's standard in-line strainer valve. Dispenser shall have an internal high flow replaceable cartridge type filter for removal of water and particulate contaminates down to 10 microns.
- Dispenser label: Provide dispenser label with the word “DIESEL” in minimum 1-1/2 inch letters on both sides.
- Reset: Dispenser shall have combination type nozzle resets and fuel ON/OFF handle.
- Hoses: Dispenser shall have coaxial product and vapor recovery hose.
- Safety shut-off valve: Replaceable combination shear/impact/fusible link valve and stabilizer assembly.
- Interface board: Dispenser shall utilize a RS 485 module to transfer information to fuel management systems.
- Internal filter elements: standard flow internal filter element.

- High hose retractor.
- Breakaway connections on dispenser hose and dispenser supply.

3.6.8.12 GASOLINE DISPENSER (SINGLE HOSE)

The gasoline fuel dispenser system shall be in accordance with the Project Technical Requirements and following additional requirements:

a. Dispenser Capacities and Dimensions. Liquid control meter and high volume remote dispensing unit shall communicate with PC and card access fuel recording systems.

- Delivery Capacity: 22 GPM maximum regulated to 8 gpm.
- Working Pressure: 50 PSI maximum.
- Operating Temperature: -30 to 150 degrees Fahrenheit.
- Hoses: Length: 12 feet; Inside diameter - ¾ inch.

b. Features and Construction.

- Cabinet construction: Dispenser cabinet shall have carbon steel top panel. Front, back and side panels shall be of hot-dipped galvanized steel with polycarbonate bezel. Unit shall have durable, scratch resistant, acrylic dial face graphic panel.
- Deadman timer circuitry: Microprocessor shall automatically be reset in the event a down condition is detected.
- No pulse timer: Timer shall automatically turn dispenser off if no pulse is detected for 255 seconds and shall turn off dispenser if both pulser channels fail.
- Interface board: Dispenser shall utilize a RS 485 module to transfer information to fuel management systems.
- Nozzle boot: Dispenser shall have front oriented nozzle boot for ¾" vapor recovery nozzle.
- Registers: Dispenser shall have 1 inch backlit LCD displays on front and back of cabinet. Registers shall be battery backed to protect against loss during power failure.
- Totalizer: Displayed on LCD by magnetic switch activation, up to 999999.
- Pulser: 0.1 gallon pulser integral with meter for interface with fuel recording system, one each.
- Solenoid valves Unit shall have two stage solenoid valves for accurate control of preset shut-off and flow control. It shall be pressure rated for system requirements, operate at 120 VAC, and factory installed as standard equipment.
- Meter: Dispenser shall have positive displacement three piston meter.
- DC Conduit: Dispenser shall include DC conduit and junction box in lower cabinet for wiring connections to fuel control systems.

- Strainer valve and filter: Dispenser shall have manufacturer's standard in-line strainer valve. Dispenser shall have an internal high flow replaceable cartridge type filter for removal of water and particulate contaminates down to 10 microns.
- Dispenser label: Provide dispenser label with the word “GASOLINE” in minimum 1-1/2 inch letters on both sides.
- Reset: Dispenser shall have combination type nozzle resets and fuel ON/OFF handle.
- Hoses: Dispenser shall have coaxial product and vapor recovery hose.
- Gasoline nozzle: Dispenser shall have 3/4 inch standard flow, CARB certified, ORVR compatible, vapor recovery nozzle with standard flow 3/4 inch swivels.
- Safety shut-off valve: Replaceable combination shear/impact/fusible link valve and stabilizer assembly.
- Interface board: Dispenser shall utilize a RS 485 module to transfer information to fuel management systems.
- Internal filter elements: standard flow internal filter element.
- High hose retractor.
- Vapor recovery: Complete Stage II vapor recovery system installed for gasoline dispensing.
- Product and vapor breakaway connections on dispenser hose and dispenser supply.

c. Dispenser Sumps.

- Construction: One piece polyethylene sump with molded structural reinforcing, integral rain lip, and perimeter liquid collection channel.
- Accessories: Stabilizer bar for shear valve and dispenser mounting frame with integral concrete anchors.

3.6.8.13 FIRE PROTECTION SYSTEMS

The Contractor shall provide fire protection systems in accordance with the Project Technical Requirements and the following subsections.

- The fire protection design requirements shall be verified and established by the Contractor based on building occupancy, configuration, and construction type.
- The preliminary design basis has considered the VUSBC as the governing code to establish fire protection requirements. The Contractor shall determine the applicability of NFPA 130 for the project and establish the applicable codes and hierarchy with the Authority Having Jurisdiction during completion of the design phase.

a. Fire Protection Requirements.

- Provide a fire protection system in the Maintenance of Way/Office Building, Service and Inspection Building, Warehouse and the Train Wash Building.

- Provide systems complying with the applicable codes and design criteria as they apply to the space and/or application being served.
- Coordinate building systems and services with the Fire Protection and Alarm systems such that there shall be, where appropriate, automatic shutdown of the affected system(s) or service(s) should any of the fire protection systems are activated. (e.g. air handling system shutdown where the associated fire protection system is activated.)
- Through the Airports Authority, coordinate fire protection requirements with WMATA's fire protection underwriter and the local Fire Department.
- All areas of the building shall be protected by a wet sprinkler system for the Maintenance of Way/Office Building and Service and Inspection Building (a wet system may be used if building is heated) and a dry pipe sprinkler system for the Warehouse, and Train Wash buildings, except as allowed below. The system shall be separately connected to the local municipal water main with connections being in accordance with the water purveyors connection and back-flow prevention requirements.

b. Flow Requirements. The systems shall be completely hydraulically designed to meet the density and flow requirements set-forth in NFPA 13, 30 and 30A. The areas of the building shall have Hazard Classifications per NFPA 13 and code.

c. Zones. Provide a minimum of five (5) zones as described below. Provide additional zones if required by NFPA and code.

- Basement of S & I Building
- 1st floor S & I bays S & I Building
- Remaining 1st floor S & I Building
- Repair Bays MOW Building
- Remaining 1st floor MOW Building
- 2nd floor office area MOW Building
- Warehouse Building
- Train Wash Building

d. System Testing. After the system has been installed, a pre-test and final acceptance test shall be performed. The testing shall be in accordance with the requirements of the appropriate NFPA sections and local and state requirements.

e. Portable Fire Extinguishers.

- All portable fire extinguishers shall be of the following types. Use of Clean Agent Systems for portable fire extinguishers is not allowed
- 10lb capacity Carbon Dioxide extinguishers with a U/L Rating of 10B:C to be used in the Communication Rooms and the Train Control Rooms.
- 10 lb ABC Dry Chemical with a U/L Rating of 4A:80B:C extinguishers are WMATA's requirements for higher hazard areas such as the TPSS, and Battery Rooms.

3.6.9 PLUMBING REQUIREMENTS SUMMARY TABLES

Table 3-2 identifies the minimum plumbing requirements for Package B. The Contractor is responsible for determining actual plumbing equipment needs based on its approved design and compliance with applicable codes, criteria, and standards

Table 3-2. Plumbing Requirements

Room #	Room Name	Hot Water	Cold Water	CA-Shop	CA-Brake	CG1	CG2	GO	WO	Emergency Eye-wash	Oily Waste	Sanitary	Remarks
S&I MAINTENANCE BUILDING													
001	Storeroom											F	
002	Elevator Equip.											F	
003	Hoist Pits			X							F		
004	Fire Valve Room											F	Floor Sink
005	UPS									X		F	
008	Wheel Truing Pit			X							F		
009	Blow Pit			X							F		
101, 101A	Store Room & Parts Counter			X									
109	Elevator Equip.											F	
110	Storage											F	
111	Men's Room	X	X									F	
112	Custodial	X	X									F	
113	Women's Room	X	X									F	
114	Tool Room			X									
120	Lube/Comp Room		X	X	X						F		
123	Wheel/Axle Shop			X							F		
125	HVAC Shop			X							F		
126	Machine Shop			X							F		

Room #	Room Name	Hot Water	Cold Water	CA-Shop	CA-Brake	CG1	CG2	GO	WO	Emergency Eye-wash	Oily Waste	Sanitary	Remarks
140	Blow Down			X							F		
150	Maintenance		X	X	X	X	X	X	X	X	T	X	
151	Truck Wash		X								T		
160	Interior Cleaning	X	X								T		
MO3	Building Systems		X										
204	Men's Locker											F	
204A	Men's Room	X	X									F	
204B	Men’s Showers	X	X									F	
205	Women's Locker											F	
205A	Women's Room	X	X									F	
205B	Women’s Showers	X	X									F	
207	Lunch Room	X	X									F	
208	Training Room		X	X	X							F	
209	Build Service Room	X	X									F	
213A	Restroom	X	X									F	
215	Janitor Room	X	X									F	
TRAIN WASH BUILDING													
101	Train Wash		X	X							T		
102	Equipment			X									
MOW BUILDING													
102	Elevator Equip.											F	
104	GMAC Shop			X									
108	UPS Room									X			
112	Plant Shop		X	X								F	
114	Women's Room	X	X									F	
115	Custodial	X	X									F	
116	Men's Room	X	X									F	
124	Mech. Room		X									F	
126	TRST Shop		X	X	X	X	X	X	X	X	T	X	
127	CETM Shop		X	X	X	X	X	X	X	X	T	X	
132	Compressor Room		X	X							F		

Room #	Room Name	Hot Water	Cold Water	CA-Shop	CA-Brake	CG1	CG2	GO	WO	Emergency Eye-wash	Oily Waste	Sanitary	Remarks
203	Training	X	X	X									
206	Men's Lockers											F	
206A	Men's Restroom	X	X									F	
206B	Showers	X	X									F	
208	Women's Locker											F	
208A	Women's Restroom	X	X									F	
208B	Showers	X	X									F	
210	Kitchen/ Lunch Room	X	X									F	
212	Conf. Room	X	X										
214	Custodial	X	X									F	
WAREHOUSE BUILDING													
102	Shipping/ Receiving										T		
103 A	Office											F	
103B	Office											F	
103C	Break Room	X	X									F	
103D	Men's Room	X	X									F	
103E	Women's Room	X	X									F	
103F	Janitor Room	X	X									F	
105	Fire Valve Room											F	Floor Sink
TRAIN WASH BUILDING													
101	Vehicle Storage										T		
102	Vehicle Storage										T		
TRANSPORTATION/POLICE BUILDING													
102	Lunch Room	X	X									F	
104	Custodial	X	X									F	
107	Women's Locker	X	X									F	
108	Men's Locker	X	X									F	
109	Training Room	X	X									X	
110	Women	X	X									F	
111	Men	X	X									F	
112	Elevator Equip.											F	

Room #	Room Name	Hot Water	Cold Water	CA-Shop	CA-Brake	CG1	CG2	GO	WO	Emergency Eye-wash	Oily Waste	Sanitary	Remarks
128	Cleaning Room	X	X									F	Mop Basin
201	Break Room	X	X									X	
205	Women's Lockers/Showers	X	X									X	
206	Women's Room	X	X									X	
207	Men's Lockers/Showers	X	X									X	
208	Men's Room	X	X									X	
214	Janitor Room	X	X									X	
215	Men's Room	X	X									X	
217	Women's Room	X	X									X	
221	Crime Scene Work Area	X	X							X		F	

Legend: CA - Compressed Air, CG - Chassis Grease, GO - Gear Oil, WO - Waste Oil, F - Floor Drain, T - Trench Drain

3.7 INDUSTRIAL EQUIPMENT

3.7.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall design, furnish, install and test all Industrial shop equipment as shown in Package B in accordance with the Project Technical Requirements and applicable criteria, codes, and standards.

The Contract Drawings illustrate equipment, and equipment quantities, to be furnished and installed as graphically indicated. Any modifications and/or substitutions of equipment shall be approved by the Airports Authority and coordinated by the Contractor, including all connections, services, opening sizes and any other construction-related requirements.

Refer to the Technical Specifications for equipment design characteristics and performance requirements. The Contractor is responsible for coordinating and integrating the industrial equipment design, installation and testing with all other disciplines to ensure a fully integrated Package B.

3.7.2 ADDITIONAL INDUSTRIAL EQUIPMENT REQUIREMENTS

The Contractor shall also comply with the following requirements when designing, furnishing, installing and installing the industrial shop equipment for Package B:

3.7.2.1 S&I BUILDING

The vehicle maintenance bays shall be outfitted with vehicle lifts in the locations indicated in the Project Technical Requirements.

These lifts shall be capable of lifting a married pair of vehicles and lowering its trucks for their replacement. Lifts shall be of C-frame design allowing the replacement of any married pair truck from the vehicle and moving it to the building's central circulation aisle while supporting the other vehicle trucks. The facility design shall allow trucks to then be moved from the central circulation aisle to the Truck Shop via turntables and embedded rail. The facility design shall also allow trucks and other heavy vehicle components to be transported throughout the maintenance bay area via a 15-ton overhead bridge crane. In addition to covering the vehicle maintenance bays, the crane shall be capable of moving trucks and other vehicle components to the Truck Shop and the major component storage area. The Truck Shop shall be equipped with four in-ground repair lifts and be situated close to the vehicle maintenance bays. The wheel true shall be a lathe type machine capable of truing vehicle wheels while still attached to the vehicle. This area shall also be supported by a 15-ton bridge crane and the central embedded rail central circulation aisle, allowing the lifting of a single truck onto the wheel truing machine. The Interior Cleaning and Blowdown bays shall work in conjunction with the preventive maintenance service cycle and have the capability to thoroughly clean the interior and undercarriages of vehicles.

In addition to feeding the Truck Shop, the central circulation aisle of the maintenance bays shall provide access to the support shops. These support shops shall contain equipment to service vehicle HVAC units, wheel/axles and gearboxes, and aid in these functions and general fabrication and wash equipment. Major pieces of equipment in the support shop include but are not limited to a wheel & axle press, wheeling boring machine and vehicle rooftop HVAC repair

lifts. The support shop shall provide the capability to service major components of trucks and the HVAC units and will be covered by a 2-ton overhead bridge crane. In addition, the support shop shall include equipment to fabricate vehicle parts that are not readily available by outside vendors. The support shop area shall also include areas for bench welding and small- to medium-sized component painting. Adjacent to the support shops shall be a clean room environment for the testing and diagnosis of vehicle electronic components. The S&I Building shall be designed to provide maintenance activities for general servicing of vehicles. Paint, body and component rebuild maintenance activities will be performed at other WMATA facilities.

Immediately adjacent to the vehicle maintenance bays will be the parts storeroom. This area shall be configured to store vehicle components and parts that are required on a frequent basis to support maintenance activities. The storeroom shall be a high-bay space capable of storing palletized items on racks and also have an area for smaller vehicle components. This storeroom shall be directly supported by the Warehouse.

3.7.2.2 WAREHOUSE BUILDING

The Warehouse shall service the Parts Storeroom and MOW workers. The Warehouse shall have two depressed docks with dock levelers for semi-truck loading and unloading and two at-grade docks for smaller parts truck deliveries. The pallet racks shall have an upper level of 16 feet, allowing the storing of palletized loads within the facilities to 20 feet high.

3.7.2.3 MOW BUILDING

The MOW Building shall provide office, crew reporting, shop and storage areas for service workers that maintain the transit system alignment and equipment required to service that line. The CTEM and TRST shops shall be outfitted with 5-ton bridge cranes, have two embedded service tracks (one of the service tracks in each shop shall have a service pit between the rails) and welding and general fabrication equipment. The majority of the remaining first floor of the building will consist of storage and light maintenance areas for field service crews and smaller clean shops for component repairs.

3.7.2.4 TRAIN WASH

The Train Wash facility shall be fully enclosed, sprinklered and heated, and shall contain equipment capable of washing the exterior of trains in a drive-thru manner. The facility shall be capable of washing (4) 8 car trains per hour. The facility shall be divided into segments that contain a wash process area (where chemicals are applied), dwell area (chemicals react to the train car material), and rinse process area (chemicals rinsed from train). Ramp access shall be provided along with proper openings in order to provide forklift access, forklift provides bulk chemical delivery and removable (55 gal drum or 250gal totes) at the equipment site. Bulk storage of chemicals needs to be provided. The facility shall have mechanical ventilation which provides air changes in order to exhaust odors and maintain proper humidity control. Air intake and exhausts shall use gravity dampers and not motorized dampers. All mechanical equipment shall be installed away from the roadway so that maintenance can be performed during revenue or roadway use.A physical barrier or wall shall be provided between the process equipment and roadway in order to protect equipment and personnel from the wash and chemicals as well as

allow for maintenance of equipment. Windows should be provided at various application points (application arches, drain area, brush area, and rinse area) in order to confirm operation of equipment. The facility shall be configured to allow trains moving through the facility at yard speed to have an adequate dwell time within the wash system to be adequately cleaned. The equipment area will contain an emergency shower/eyewash station due to the chemicals used and stored in this area.

The wash system shall be equipped with two applications arches (one acidic and one alkaline), spinning brushes, pre and final rinse high pressure arches, and a high velocity air stripping arch. The wash water shall be heated (tempered) in order to properly mix the soap as well as softened for soap and rinse application. The water needs to have proper ph correction for recycling and discharge. The wash system shall be equipped with a cyclonic type water reclaim system and the various wash arch components shall utilize a mixture of fresh and reclaimed water to promote fresh water conservation while still providing an effective vehicle wash. Discharge of water from any of the train wash processor tanks shall be controlled in order to meet all regulatory compliance.

The wash system shall have external and remote indications of system and train speed status. The physical position or movement of trains shall initiate or stop various wash and rinse procedures. The train wash shall be PLC controlled, with all remote PLCs and controllers communicating back to a main PLC. The main PLC shall have a Human Machine Interface (HMI), a secon HMI shall be installed in the yard control tower for basic interaction. The controls shall be capable of data logging, trending data, emailing predefined events/alarms, on and off capability of various processes and equipment.

SECTION 4. SYSTEMS

4.1 POWER DISTRIBUTION SYSTEM

4.1.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall design, furnish, install and test all systems, equipment, and facilities necessary to deliver a complete, safe and operational Medium Voltage (MV) 34.5 kV power distribution system for Package B in accordance with the Project Technical Requirements and applicable criteria, codes, and standards. The Contractor shall also design, interface, schedule with the Package A contractor, and obtain necessary utility power connections for all 34.5kV utility power requirements and shall provide a means to deliver power to the substations and the fixed facilities in Package B. The Contractor shall comply with all relevant utility requirements and regulations including: predicted loads, equipment ratings and insulation levels, surge and lightning protection requirements, short circuit levels, grounding, switching, cables and cable routes, ductbanks and manholes, access and isolation requirements. The Contractor is responsible for coordinating and integrating the power distribution system design, installation and testing with all other disciplines to ensure a fully integrated Package B.

4.1.1.1 DOMINION VIRGINIA POWER RESPONSIBILITIES

Dominion Virginia Power (DVP), the electrical utility company, is responsible for supplying and installing all required equipment necessary to provide 34.5 kV power for Phase 2 of the Project (including Packages A and B) in accordance with its requirements and equipment specifications. DVP scope shall include the provision, installation, and commissioning of: 1) equipment at the DVP substation, 2) power metering equipment, and 3) cables, splices, and attachment hardware for the 34.5 kV connection of the DVP sub-station to the meter.

4.1.1.2 PACKAGE A CONTRACTOR RESPONSIBILITIES

The Package A Contractor will coordinate with DVP for the 34.5kV power feeds required to provide power to the traction power system and related fixed facilities. The Package A contractor will be responsible for the design, construction and installation of:

- Separate ductbanks necessary for the 34.5 kV power feed and distribution system. The 34.5 kV power distribution ductbanks and cables shall be located within existing or planned public rights-of-way, Airports Authority property, hidden from public view, and shall not be attached to non-WMATA structures.
- The interface manhole where the 34.5 kV power distribution system shall connect to the ductbank feeding the Rail Yard and Maintenance Facility.
- The design and installation of each MV switch pad that will be the interface point between the Package B 34.5kV power distribution ductbank at the traction power substation in Package A.

The provision, installation, and commissioning of the 34.5 kV connection between the switch and the MV switchgear at the connection facility.

4.1.1.3 PACKAGE B CONTRACTOR RESPONSIBILITIES

The Package B Contractor will be responsible for the design, construction and installation of:

- The design and construction of the ductbanks and cables necessary for the 34.5 kV power feed and distribution system between the interface manhole, provided by the Package A contractor and all facilities in Package B.
- The cable installation and splices in interface manhole where the 34.5 kV power distribution system shall connect to Package A-provided cables feeding the Rail Yard and Maintenance Facility.
- The connection of the cables, provided by the Package A Contractor, to the switch at TPSS #18.
- The design and installation of each MV switch pad that will be the interface point between the 34.5kV power distribution ductbank at each traction power substation and facility location in Package B.
- The testing and commissioning of the 34.5 kV connection between the switch at TPSS #18 and the MV switchgear at each connected facility.

4.1.2 ADDITIONAL POWER DISTRIBUTION SYSTEM REQUIREMENTS

The Contractor shall also comply with the following requirements when designing and constructing the power distribution system for Package B:

a. All cables intended for installation in the 34.5 kV power distribution system shall be manufactured to an acceptable standard with respect to flammability and smoke and fume emissions. The external insulating and protective sheaths of such cables shall be flame retardant, low smoke, zero halogen emitting material. Fire proofing protection shall be applied on all 34.5kV cables within manholes per DVP requirements.

b. The MV switchgear installation clearances shall conform to DVP criteria.

c. Provide calculations for the yard TPSS and shop substation ratings and in support of the grounding system design.

d. When permanent power has not been provided in the traction power substations and tie breaker stations, the Contractor shall provide the necessary temporary power for his work in accordance with General Conditions. The Contractor shall protect the equipment. In equipment such as switchgear and bus ducts in which there are internal space heaters, the space heaters shall be kept energized to avoid condensation. If permanent power for the space heaters is not available, the Contractor shall provide the necessary temporary power.

e. The Contractor shall include all necessary operational and safety signage and equipment in accordance with WMATA, DVP and other applicable requirements and in accordance with these Project Technical Requirements.

4.2 TRACTION POWER SYSTEM

4.2.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall design, furnish, install, and test all systems, equipment, and facilities necessary to deliver a complete, safe, and operational traction power system for Package B in accordance with the Project Technical Requirements and applicable criteria, codes, and standards. The traction power system consists of the contact rail and feeders, sectionalizing equipment, rectifier substations with high-voltage connections, tie-breaker stations, distribution cabling systems, contact rail heating systems and associated remote control SCADA systems. The Contractor is responsible for coordinating and integrating the traction power system design, installation and testing with all other disciplines to ensure a fully integrated Package B.

The PE design for Package B includes two TPSS facilities. The TPSS at the west end of the facility shall include two 3-mW transformer/rectifiers with a total capacity of 6 mW. The TPSS facilities shall also include buildings and other provisions to facilitate the future expansion of each TPSS to 9 mW by only adding a transformer/rectifier lineup and the associated switchgear, monitoring, and metering equipment. The TPSS near the connection to the yard lead tracks shall include three 3-mW transformer/rectifiers with a total capacity of 9 mW. For these facilities, the general arrangements shown in the PE design shall apply. The Contractor is responsible for meeting all equipment spacing, accessibility and maintenance requirements.

The TPSS shall either utilize a) a pre-fabricated, modular design, and installed at-grade with outdoor oil-filled transformers on concrete foundations, with code compliant oil containment systems and architectural screening meeting Loudoun County and Airports Authority requirements, or b) free-standing facilities in the same locations. These buildings shall comply with all WMATA criteria and meet applicable screening requirements. The designs for pre-fabricated substation facilities shall include all required electrical and mechanical systems. These facilities shall be designed, manufactured, and installed in a manner that provides a pleasing and homogeneous appearance. Units shall be as low in profile as possible. Units of the same type and rating shall be identical and interchangeable.

The yard/shop traction power system shall be similar to the mainline traction power system, except as noted below:

- In lieu of the ETS network used on the mainline, a “Yard Master Trip” arrangement shall be used, as required in the Project Technical Requirements.
- The negative system of the yard traction power system is isolated from the negative system of the mainline and shall not be deliberately grounded.
- The negative system of the shop traction power system is isolated from the negative system of the yard, and the shop tracks shall be grounded.
- Sectionalizing of the Yard contact rails shall be provided using wayside DC disconnect switches.

4.2.2 ADDITIONAL TRACTION POWER SYSTEM REQUIREMENTS

The Contractor shall also comply with the following requirements when designing and constructing the traction power system for Package B:

a. Power to the S&I Shop Stingers, dc pedestals and wall mounted contactors shall be provided by a dc power substation located in the Service and Inspection (S&I) shop, separate from the yard. AC input power to the transformer-rectifier unit shall be supplied through MV switchgear capable of selecting either one of the two incoming MV sources. The metal enclosed dc switchgear shall supply dc power to the dc Switchboard containing combination fused switches and magnetic contactors for the stinger system and the fused switches for the pedestal and wall mounted contactors. DC switchgear shall also supply power to the wash track and any other maintenance track contact rails. The negative output of the rectifier that is connected to the shop tracks shall be solidly grounded. Shop tracks shall be isolated from the yard tracks. A back-up arrangement to supply dc power to the S&I shop from the Yard contact and running rail shall be provided in the event that the shop transformer-rectifier unit fails.

b. The equipment shall be designed, fabricated, and installed in accordance with the Project Technical Requirements. The arrangements shall result in minimum space requirements for the substations, adequate clearances and accessibility and suitability of arrangement with other equipment. Components, design and construction shall be chosen to provide a pleasing and homogeneous appearance.

c. The Contractor shall be responsible for providing all required support from equipment manufacturers during field-assembly, installation, testing and start-up of each traction power facility. The same calculations and studies as are required for the mainline traction power system shall be provided for the Yard traction power system.

d. Contact rail heater tape shall be installed on all contact rails within the yard. The Contractor shall develop final plans consistent with these suggested plans and the final third rail layouts.

e. The Contractor shall develop contact rail cable schedules consistent with the Project Technical Requirements. Conduits, ductbanks, and stub-up arrangements shall be designed and developed to provide efficient and shortest possible cable runs, while being consistent with mainline designs.

f. Running rail cable bonding shall be designed consistent with the signaling / ATC design. Negative rail cable bonding jumpers shall be exothermic welded. Plans and drawings shall be developed showing double line track circuits and negative return cable bonding throughout the yard and yard leads.

g. DC control and alarm circuits for stinger operation shall be run in separate and dedicated conduits.

h. Grounding of shop running rails shall be accomplished using the single point grounding concept. Shop tracks shall be bonded together, but purposely isolated from grounded

structures, and with a single point of return to the dc shop rectifier negative, and grounded at the rectifier negative bus.

i. Bonding and grounding at the truck lifts and the car body lifts shall be provided to allow the vehicle auxiliary power to be energized while the trucks motor assemblies are lowered and disconnected from the vehicle. Such a scheme needs to be coordinated with the lift design and traction power return circuit.

j. Negative return circuits for the car wash need to be separated from the yard tracks and designed to return to the rectifier negative by separate cabling circuit.

k. The yard Traction Power SCADA system shall be designed to be a stand-alone, controlled from the Yard tower, and shall provide control and monitoring in accordance with the Project Technical Requirements.

l. The location of the contact rail elements, gaps and breaks shall be coordinated with the traction power designs and revised as necessary to ensure that unobstructed emergency egress paths and maintenance walkways are provided in accordance with WMATA standards and NFPA 130 requirements.

m. The location of contact rail gaps and breaks shall also be coordinated with the emergency egress requirements at crossovers in the vicinity of stations, where evacuation points within the limits of crossovers shall have fences and gates that have to be properly located.

n. The NDC DC breaker currently used on the Phase 1 is acceptable for the Package B traction power system. As necessary during the completion of its design, the Contractor shall revise the requirements in Technical Specification 16341 (Metal Enclosed DC Switchgear) to allow the use of NDC dc breakers.

o. The TPSS and TBS facilities shall be situated so that equipment is not flooded in the event of a 100-year storm.

4.2.2.1 LOAD FLOW STUDY

For Phase 2, WMATA has approved DSCPs relaxing the WMATA Design Criteria, Release 9 traction power system requirements. The Contractor shall prepare a load flow analysis of the Yard traction power system requirements using the assumptions defined in the Yard Load Flow Analysis provided in **Appendix 6**.

The Contractor's Load Flow Study shall include the utility connections, selected rectifier technology, electrical distribution systems and selected substation capacities that the Contractor is proposing. The load flow study shall also define the criteria for trackwork bonding, including cross-bonding between tracks. All inputs and assumptions shall be confirmed with the Airports Authority prior to completing the study.

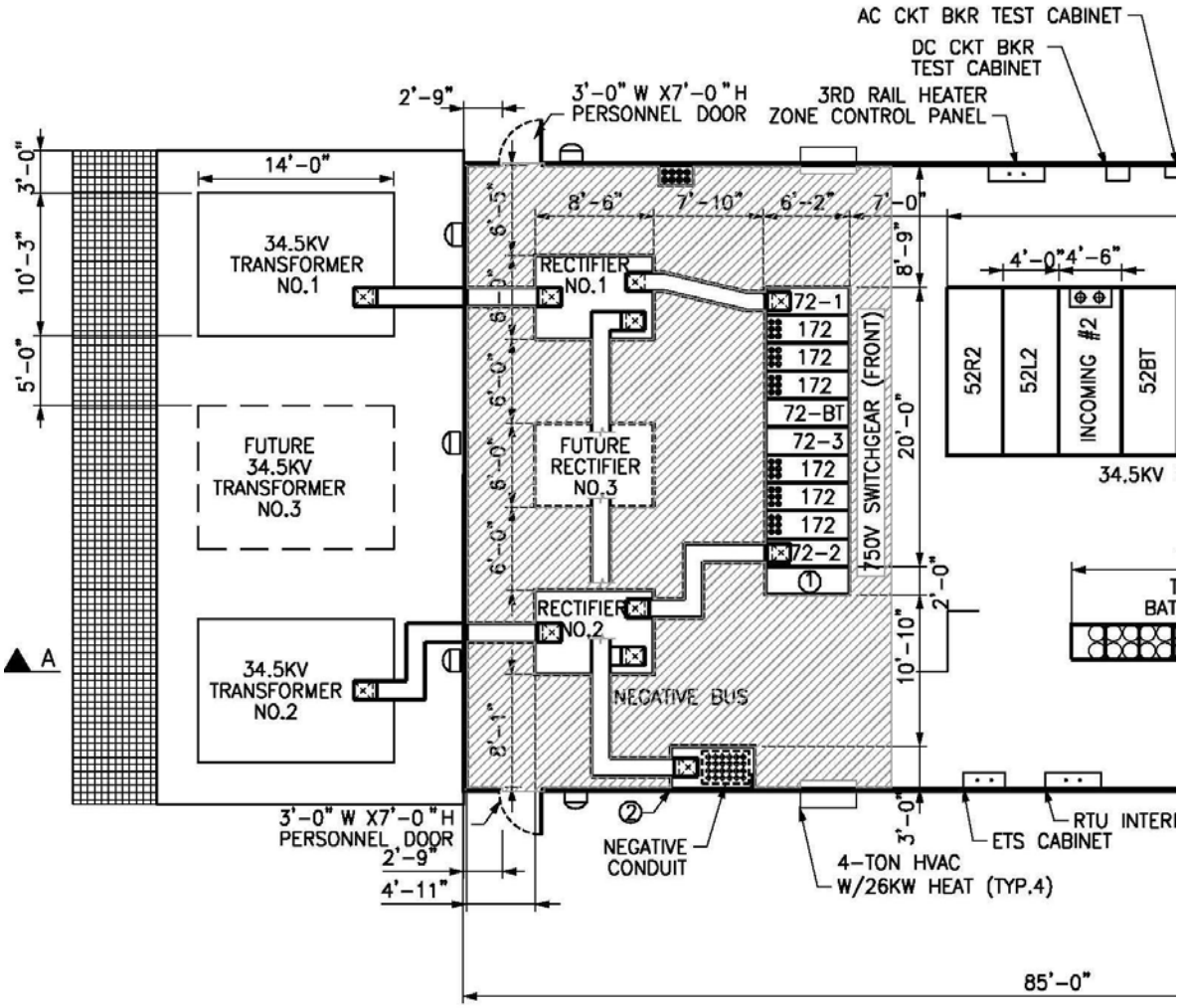
4.2.2.2 34.5 KV SERVICE CONNECTIONS

The Contractor shall provide 34.5kV-power connections for traction power substations and all other utility power requirements for Package B, including any temporary power requirements for construction purposes. The Contractor shall comply with all relevant utility requirements and regulations, including: equipment ratings and insulation levels; surge/lightning protection requirements; short circuit levels; grounding; switching; cables and cable routes; metering; access and isolation requirements; power factor; harmonics; and protection coordination. The Contractor shall ensure that the utility company is made fully aware of the predicted loads.

4.2.2.3 TRACTION POWER EQUIPMENT

a. The Contractor shall furnish, install, connect, energize and test all required material and equipment necessary for the installation of the following traction power subsystems:

- 34.5 kV Voltage A.C. Switchgear
- Transformer-Rectifier Units
- DC Switchgear
- Drainage and Negative Switchboard
- Substation Busways
- Local Annunciator Panel/HMI
- Wire and Cable
- Battery Systems
- Uninterruptible Power System (UPS)
- Emergency Trip Stations (ETS) and Remote Monitoring
- Contact Rail Heating System
- Shop Equipment
- Grounding and Bonding
- Oil-water Separators and Drainage



b. All traction power substations shall be arranged to accommodate three rectifier-transformers in a single line as shown in the diagram below, rather than the "L" arrangement shown in the site-specific PE plans for each substation.

c. The Contractor shall provide a report (or reports) documenting the results of all electrical calculations used to substantiate its traction power system design, including, but not limited to:

- Short circuit calculations for all electrical service connections used to determine setting protection relays for AC and DC feeder breakers, and utility substation circuits. These calculations shall verify overcurrent, short-circuit, and (if applicable to the Contractor's design) di/dt and delta i protection settings for AC, downstream circuit breakers and fuses and DC traction power circuit breakers. Local and remote short-circuit levels, calculation of circuit breaker steady and peak load currents, and protection coordination curves calculations are also required.

- Composite coordination curves which demonstrate that the setting of the protection devices are adequate to protect medium voltage cable supplying rectifier transformer, rectifier-transformer and rectifier diodes under the maximum short circuit conditions and allowing the equipment to supply the specified overloads.
- UPS system and battery selection calculations.
- Calculations to determine setting(s) of temperature sensing devices for transformer winding temperature, oil temperature and diode junction temperature.
- Grounding system design. The Contractor shall incorporate measures to protect against stray DC traction power current into Package B. Such measures shall include grounding and bonding, isolation, insulation, cathodic protection, and other means to contain and mitigate stray current as specified in the Project Technical Requirements. The Contractor shall also coordinate and cooperate with utility companies and other affected parties along the alignment to ensure that necessary mitigation and protection measures are incorporated.

d. The Contractor shall include all necessary operational and safety signage and equipment in accordance with the Project Technical Requirements and WMATA, OSHA and other applicable requirements.

4.3 STRAY CURRENT AND CATHODIC PROTECTION

4.3.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall design, furnish install, and test a fully compliant stray current and cathodic protection system for Package B in accordance with the Project Technical Requirements and applicable criteria, codes, and standards. Corrosion control measures are intended to prevent the premature failure of metallic components and mitigate stray current during normal rail operations. Stray current and cathodic protection shall be required for all new facilities regardless of location, owner, or material of construction when corrosion failure of such facilities may affect safety and/or continuity of rail operations. The Contractor is responsible for coordinating and integrating the stray current and cathodic protection system design, installation and testing with all other disciplines to ensure a fully integrated Package B.

4.3.2 ADDITIONAL STRAY CURRENT AND CATHODIC PROTECTION REQUIREMENTS

The Contractor shall also comply with the following requirements when designing and constructing the stray current and cathodic protection system for Package B.

4.3.2.1 BASELINE CORROSION STUDY

The Contractor shall conduct a baseline corrosion study to collect data necessary for the design of corrosion control subsystems and to establish existing levels of stray current activity that will cross or be located adjacent to Package B.

The baseline corrosion study shall include, at a minimum, the measurement of soil resistivity at approximately 1000-foot intervals along the proposed transit route, measurement of soil pH, chloride ion content and sulfate ion content at selected locations to determine the soil corrosivity to buried reinforced concrete structures, and cooperative testing with utility companies to establish the existing levels of stray current activity on metallic structures that cross or will be located adjacent to the transit route.

The actual frequency, depth and extent of testing shall be appropriate for use in stray current modeling, the design of the corrosion control subsystems and as a reference for comparison to commissioning and post revenue test results.

4.3.2.2 ATMOSPHERIC CORROSION CONTROL

The Contractor shall manage atmospheric corrosion through proper materials selection and coating systems, manage underground/submerged corrosion through materials selection, coatings and cathodic protection, manage stray current corrosion through the use of an ungrounded, segregated (mainline, yard, shop) traction power distribution system and assure electrical continuity of metallic reinforcement in fixed transit facilities that are adjacent and parallel to the track route. All corrosion control designs shall be based on industry best practices and protection of the environment shall be incorporated into all designs where feasible and appropriate.

4.3.2.3 CATHODIC PROTECTION

Galvanic cathodic protection systems shall be designed and installed. Impressed current cathodic protection systems shall be utilized only when the use of galvanic cathodic protection is not technically or economically feasible. Cathodic protection system designs that require a connection to the traction power distribution system negative return system are not permitted. Cathodic protection system designs shall follow the guidelines provided in the following standards:

- NACE International SP0100 (Cathodic Protection to Control External Corrosion of Concrete Pressure Pipelines and Mortar-Coated Steel Pipelines for Water or Waste Water Service)
- NACE International SP0169 (Control of External Corrosion on Underground or Submerged Metallic Piping Systems)
- NACE International SP0187 (Design Considerations for Corrosion Control of Reinforcing Steel in Concrete)
- NACE International SP0290 (Impressed Current Cathodic Protection of Reinforcing Steel in Atmospherically Exposed Concrete Structures)
- NACE International SP0408 (Cathodic Protection of Reinforcing Steel in Buried or Submerged Concrete Structures)

All cathodic protection system designs shall be performed by a NACE International-certified Cathodic Protection Specialist.

The cathodic protection system shall include provisions for electrical continuity of the protected structure(s) and electrical isolation of the protected structure(s) from unprotected interconnected structures, non-transit owned utility piping, grounded structures, casings, structure penetration sleeves, etc. Electrical isolation materials may also be utilized to segregate the structure(s) into discrete electrically isolated sections where necessary depending upon the total length and/or configuration of the structure(s). The types and locations of cathodic protection testing facilities shall be specified in the corrosion control designs. The type and number of testing facilities specified shall be adequate to accurately evaluate the performance of the corrosion control system. At a minimum, testing facilities shall be specified for all electrical isolation fittings, cased pipeline locations, anode installation locations, and bonding facilities to foreign structures.

4.3.2.4 STRAY CURRENT CONTROL

The Contractor shall utilize an ungrounded traction power distribution system to control stray current at the source under normal operating conditions. The design and construction of the stray current control system shall be closely coordinated with track electrification, train control, and track design.

The primary factors that can be controlled are the track-to-earth potential and the track-to-earth resistance. To control the track-to-earth potential, the resistance and current flow of the negative return circuit shall be considered. The current flow is a function of train consist power requirements and spacing of the traction power substations. Load-flow modeling shall be performed to estimate current flow and rail-to-earth potential in the distribution system and,

utilizing soil resistivity data from the baseline corrosion survey, estimate the magnitude of stray current emissions.

The resistance of the negative return circuit shall be managed through the use of continuously welded rail (CWR), bonding of mechanical rail joints, rail-to-rail bonding, track-to-track cross bonding, sizing of feeder cables, and the use of impedance bonds at rail isolation joints for signaling/train control. The track-to-earth resistance of the running rails shall be managed through the use of electrically isolating rail pads and fasteners, high resistance concrete crossties, electrically isolating the reinforcement of the second pour/plinth for direct fixation locations, special construction practices for embedded track and grade crossings, maintaining a minimum 1-inch separation between the rail base and ballast, electrically isolating rail appurtenances and equipment such as switch machines, signaling devices, communications devices, or other grounded devices that may contact the return circuit. The minimum acceptable track-to-earth resistance shall be 500 ohms per 1,000 track feet (2 rails). Additionally, traction power distribution shall be segregated for the mainline tracks, yard tracks and shop facility. The tracks in a shop facility are intentionally grounded for personnel safety purposes and must be electrically separated from the yard tracks to maintain adequate stray current control. To maintain electrical isolation of the positive distribution circuit from ground, the design shall include the use of electrically isolating support posts and pads, continuously welded contact rail and, bonding of contact rail expansion joints. The minimum acceptable contact rail-to-earth resistance shall be 40 megohms per 1,000 feet. As with the negative distribution circuit, the positive traction power distribution shall be segregated between the mainline track, yard track, and shop.

4.3.2.5 STRAY CURRENT DRAINAGE PROVISIONS

At each traction power substation, an enclosure shall be installed adjacent to the negative switchboard that contains provisions for drainage of stray current. The stray current drainage provisions shall include termination of connections to transit fixed facility reinforcing steel, and/or foreign metallic utilities (as necessary) as well as all embedded conduits into the substation. The terminations shall be made to a drainage bus through normally open relays, current measuring shunts, current limiting devices and current reversal blocking devices. The drainage bus shall be connected to the negative bus of the traction power substation.

Connection of metallic structures to the negative bus through the drainage facility shall be avoided unless demonstrated to be necessary through testing and a thorough engineering evaluation. The testing and evaluation shall be performed by or under the direct supervision of a NACE International Cathodic Protection Specialist with experience specifically in the area of transit stray current control.

4.4 YARD TRAIN CONTROL

4.4.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall design, furnish, install, and test a complete, safe, and operational Yard Train Control system for Package B in accordance with the Project Technical Requirements and applicable criteria, codes, and standards. The Contractor is responsible for coordinating and integrating the train control system design, installation and testing with all other disciplines to ensure a fully integrated Package B, and for ensuring that the train control system is fully compatible with the Package A and existing WMATA train control systems. The Contractor shall provide the following services in the manner specified.

Train control for the yard shall begin at opposing signals 16/18 on YL1, 20/22 on YL2, and 50/52 on YL3 lead tracks as shown in the Contract Drawings. The Yard interlocking shall consist of one main TCR room located in the Yard Service and Inspection Building and four satellite TCRs located throughout the yard and on the yard lead tracks as described in the Project Technical Requirements. TCR (N99) will be controlled from the Yard Tower. The satellite TCRs are designated N99A, N99B, N99C, and N99E. N99E will be provided by the Package A Contractor.

The yard control machine in the Yard Tower will interface with the WMATA personnel that perform the tasks associated with establishing routes for trains in the yard. A fully integrated connection with WMATA's OCC systems and yard consoles shall be provided. The yard control machine will also interface with the yard control system which will perform the necessary train control functions for the yard. These yard train control functions shall include:

- Route Locking
- Traffic Locking
- Approach Locking
- Detector Locking
- Sectional Release
- Switch Control and Indication
- Preliminary and Final Route Checks
- Grade Crossing Circuits

4.4.2 ADDITIONAL AUTOMATIC TRAIN CONTROL REQUIREMENTS

The Contractor shall also comply with the following requirements when designing and constructing the train control system for Package B:

a. The train control equipment and systems provided in Package B shall be immune to interference from all transit vehicle electrical subsystems, all adjacent parallel and transverse utility power lines and to interference from any WMATA VHF hand held radio transmitter or cell phone keyed at a distance of six inches from the equipment or system.

b. The interlockings shall be equipped with processor systems that perform the non-vital interlocking functions represented by the non-vital interlocking circuits shown in the PE design. Non-vital interlocking diagnostic functions shall also be accomplished by means of these microprocessor-based systems.

c. The Contractor shall implement a safety program for all areas of Package B wayside and trackways equipped with train control equipment or facilities to ensure the safety of the installed train control equipment, circuits and systems, and the safety of all personnel involved in the associated installation and testing activities.

d. Each train control drawing includes a WMATA Drawing Number that is based on the control point assigned to the associated segment of track. During design, the numbering scheme for all locations shall be finalized by the Contractor in coordination with WMATA.

e. Dragging equipment detectors shall be provided and installed in the vicinity of the opposing signals as shown on the Contract Drawings.

f. Cable troughs shall be provided and installed in the yard to serve all of the Yard Train Control wayside equipment, track circuits as well as Yard Train Control Power cabling.

g. The Data Transmission System (DTS) described in Technical Specification 16925 includes Remote Terminal Units (RTUs) to provide the interface with the communications backbone. Presently, WMATA is implementing a new DTS architecture that uses a non-vital processor to provide this interface and eliminate the need for RTUs in the TCRs and TCERs. Detailed technical information regarding the new DTS architecture is not available at this time. The Contractor's offer shall be based on a DTS that does not require the use of ATC system RTUs.

4.5 COMMUNICATIONS

4.5.1 SUMMARY OF CONTRACT REQUIREMENTS

The Contractor shall design, furnish, install, and test a complete, safe, and fully operational communications system for Package B in accordance with the Project Technical Requirements and applicable criteria, codes, and standards. The Contractor is responsible for coordinating and integrating the communications system design, installation and testing with all other disciplines to ensure a fully integrated Package B. The major sub-systems to be provided as components of the Communications System are:

- Fiber Optic System (FOS) and Local Area Network/Wide Area Network (LAN/WAN)
- Integrated Public Address System
- Talkback System
- Voice Over Internet Protocol Telephone System (VoIP)Mobile Radio System
- Radio System
- Closed-Circuit Television System (CCTV)
- Fire and Intrusion Detection System
- Supervisory Control and Data Acquisition (SCADA) System

The Contractor is responsible for coordinating and integrating the communications system design and construction with all other disciplines to ensure a fully integrated design, and for ensuring that all communications systems are fully compatible with the Package A and existing WMATA communications systems.

4.5.2 ADDITIONAL COMMUNICATIONS REQUIREMENTS

The Contractor shall also comply with the following requirements when designing and constructing the Communications system for Package B:

a. Fire detection devices in unconditioned spaces shall be compatible with the environmental conditions of the spaces in which they are installed

b. Communications equipment and systems provided under this Contract shall be immune to interference from all transit vehicle electrical subsystems, and to interference from any WMATA VHF/UHF hand held radio transmitter or cell phone keyed at a distance of six inches from the equipment or system.

c. Communications equipment provided by the Contractor shall be capable of working safely during lightning storms, ground faults, and electrical surges and provide necessary protections to prevent damage to other Communications equipment and injury to personnel from due to short circuits or overload conditions.

d. The Communications system and equipment shall be designed for accessibility and ease of maintenance.

e. The Yard Communications Systems shall be designed to provide state-of–the–art, efficient, reliable Communications between all Yard Facilities and shall be interconnected with the System wide LAN/WAN Ethernet Communications Network.

f. The Contractor shall provide a structure cabling plant to support IP transport systems in all facilities within the yard complex, Where distance limitation do not support structured cabling design, fiber optic transport shall be utilized, with media convertors. All transport media equipment shall be fully protected, enclosed and accessible for maintenance without the need to use ladders.

g. Communication room rack and cabinet layouts shall be designed and placed to provide efficient air flow. The Contractor shall coordinate with the mechanical HVAC design and perform CFD analysis to show cabinet and rack air flows are maintained within manufacturer's recommendations.

h. The design of the communication systems with interfaces to other sub systems shall be clearly documented in the drawings, specifications and tracked in accordance with the Contractor's Interface Control Plan.

i. The computer IT data / phone network designs for all the yard facilities shall include multiple quad outlet RJ-45 drops, fully wired, in each office and in equipment rooms for connectivity to WMATA LAN infrastructure. The number of outlets shall be determined during the design phase and approved by the Airports Authority. In general, office walls with a desk, phone and or copier / fax shall be fitted out with the network data outlet. Repair shops and equipment rooms shall have outlets strategically placed for computer connectivity and consistent with phone placement. Sufficient patch panels and switch port aggregation shall be included in all communication room facilities to accommodate the high density IT network.

4.5.2.1 FIBER OPTIC SYSTEM

A Fiber Optic System (FOS) will provide the transmission medium for Voice and Data signals between the Yard and the System wide Communication Network. This will provide communications from the Yard to the Operations Control Center (OCC) located at Jackson Graham Building (JGB), and Carmen Turner Facility (CTF). To maintain maximum reliability and route diversity, the Primary and Secondary Fiber Optic cables installed along the mainline from the Dulles Airport Station shall be brought into the Yard with a Primary cable drop at the MOW Building and a Secondary cable drop at the S & I Building. The cables shall be installed in Fiber Optic innerducts within the Rail Yard ductbanks. The Primary and Secondary cables shall then be routed out of the Rail Yard outbound toward the Route 606 Station. In this manner route diversity shall be provided to the Yard with communication links going outbound and inbound along the mainline and with cable drops in two different Yard buildings.

4.5.2.2 PUBLIC ADDRESS SYSTEM

The IP based Public Address System shall provide for announcements to be made in all the Yard buildings including Gatehouse, Train Control Rooms and Traction Power Substations. Individual buildings will be selected as zones and ALL CALL announcements capability shall be provided. The Contractor shall provide acoustical sound pressure level (SPL) calculations and place speakers to obtain a level of 50 over background ambient noise,

4.5.2.3 TALKBACK SYSTEM

The Yard Talkback System will provide paging and two way communications between the Yard Communications Console located in the Yard Control Tower Room and talkback stations located along the tracks throughout the yard area. Suggested locations of talkback speakers are shown on the plans; the Contractor shall submit final layouts for approval. Talkback communications shall also be available from the Gatehouse Console.

4.5.2.4 TELEPHONE SYSTEM

The Yard Telephone System shall consist of an IP based VOIP telephone service distributed throughout each Yard facility utilizing Category 6 structured cabling. The VOIP server controlling Yard telephone service shall be located at the JGB with a backup at CTF. In the event of network failure in the connection to JGB, VOIP Gateways with Processors shall be installed at both the MOW Building and the S&I Buildings. Both locations shall also be provided with direct trunking connections to the Public Switching Network. In this manner, yard telephone service inside and outside the yard shall be maintained whether or not the VOIP servers at JGB can be reached. IP telephones will be provided to administrative personnel. Analog telephones, connected to the IP network via Gateways, shall be provided for all service functions.

4.5.2.5 RADIO SYSTEM

Yard Dispatcher's Mobile Radio Subsystem shall provide two-way voice communications between a fixed radio base station to be installed in the yard complex and WMATA Yard personnel using hand-held radios within the confines of the yard and lead track areas.

4.5.2.6 CLOSED CIRCUIT TELEVISION SYSTEM

The Yard CCTV System shall be IP based with its own Network Video Recorder (NVR). The CCTV System shall be controlled with the same Video Management System (VMS) as currently used by Phase 1 and as such can be accessed from the OCC. The Yard NVR shall primarily store video data from the Yard cameras. However, because it is under VMS control from the JGB, the Yard NVR shall be also used as backup storage for any NVR failure on the network. The cameras to be installed in the Yard shall all possess Pan, Tilt and Zoom (PTZ) control to provide wide surveillance coverage throughout the Yard. The Yard Control Tower and Gatehouse attendants shall be given access to the Yard CCTV system. The Yard Control Tower attendants shall use this capability to maintain close surveillance of each interlocking switch location. The Gatehouse attendant shall use the Yard CCTV System for general Yard surveillance, particularly the peripheral remote areas and also to monitoring all vehicles entering and leaving the Yard.

4.5.2.7 FIRE INTRUSION ALARM SYSTEM

A state-of-the-art, smart, NFPA 72 code compliant, addressable, software-programmable Fire and Intrusion Alarm (FIA) System shall be designed for the yard. The software driven, FIA System shall be designed to report detected events to FIA Annunciator Panels located at both the Gatehouse and the Yard Control Tower. The FIA Annunciator Panels shall be mounted in a custom-made Communications Console that shall be a self-contained tabletop console, housing a Talkback Control panel, CCTV monitors, and other subsystem control panels that may be required for the location.

4.5.2.8 SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM

A SCADA system shall be provided for transport of non-vital control data and indications. SCADA communications shall be provided between each location and the OCCs located in the Jackson Graham Building and the Carmen Turner Facility.