Request For Proposals

Metrorail Faregates

RFP No. : FQ18152

PART III

TECHNICAL SPECIFICATIONS

STATEMENT OF WORK

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1 Scope Summary

1.1 Overview

The Washington Metropolitan Area Transit Authority (WMATA, or Metro) is soliciting proposals to support the acquisition, deployment and maintenance to replace current faregates. The objectives of this effort are to:

- Modernize WMATA's faregates;
- Improve the customer experience;
- Improve operational interfaces;
- Increase faregate reliability;
- Reduce opportunity for fare evasion;
- Reduce power consumption;
- Provide a pleasing design that is complementary to WMATA's historic design aesthetic. and
- Implement hardware which seamlessly interfaces with the Cubic Tri-Reader 4 (TR4) to execute the proper patron-facing faregate actions based on the results of the media processing by the TR4.

Faregates shall replace current faregates across WMATA's 91 Metrorail stations, 118 Metrorail Mezzanines and 13 mini-Mezzanines (exits away from station kiosks) in Washington, DC, Maryland and Virginia. This effort will replace WMATA's existing faregate cabinets and expand the number of faregates on some mezzanines. Additionally, WMATA may, as a contract option, supply faregates and supporting equipment to nine new Metrorail Mezzanines that are being constructed as part of the Purple Line (2) ,Silver Line (6) expansion and Potomac Yard (1).

WMATA currently uses contactless smart card technology for fare payment and to interface with faregate entry and exit controls. New faregates shall continue to provide a barrier to mezzanine entry and exit until a passenger presents valid fare media. Faregates shall interface with WMATA's current payment application (part of the Cubic supplied Nextfare® 5 platform) and facilitate controlled entry and exit, in accordance with WMATA's fare tariff.

Faregate control and management shall be supported from centralized and local applications. Station equipment shall include Station Terminals and Station Manager Portable Devices that support faregate management and have the capability to read WMATA fare media to assist customers with fare media issues. The faregate solution shall provide hardware and software solutions to support local and centralized faregate management, access controls, system monitoring and reporting, remote faregate diagnostics and web accessed status dashboard reporting.

The Systems Integrator shall supply Payment Processing Targets (PPT) that shall interface with the current WMATA payment application and the current Nextfare 5 backend system. The contractor shall work with the Systems Integrator to install and

deploy these PPTs within the faregate such that the faregate correctly responds to the results of media processing by the PPT. The Contractor shall work with the Systems Integrator to develop an Interface Control Document (ICD) that shall outline the communications protocols, messaging methodology and formats used between the System Integrator's PPT and the faregate (SBC). The Contractor and the Integrator shall jointly be responsible for the development and testing of the interface.

In addition to station devices, the Contractor shall provide and install equipment for WMATA's AFC Engineering Simulation Lab, Maintenance Training Lab, Revenue Facility, and Maintenance Repair Shop.

Faregates shall be designed and configured to be ergonomically acceptable and to allow the greatest number of passengers to pass through from either direction. Faregates shall be designed to operation in a wide range of environmental conditions, including outdoor environments and cold and hot temperatures. Faregate design shall also include design features that are modern and aesthetically pleasing while including coloring and design accents that are complementary to WMATA's historic design.

Faregates and associated mezzanine equipment shall utilize the WMATA communication networks MetroNet wide area network and MetroNet Wi-Fi communications infrastructure to support system interfaces. WMATA's MetroNet utilizes a fiber optic backbone to each Metrorail station mezzanine that is controlled and operated by WMATA.

The Contractor will be responsible for the delivery of a turnkey solution and will be responsible for coordination with WMATA's current fare payment system provider. This coordination includes legal agreements and responsibility for delivery of software modifications to the current fare system to support the system integration needed to deliver a solution where faregate functionality interfaces with the current fare payment application which manages WMATA's fare tariff and the distribution of web sales transactions, refunds, "hot listed" fare media, and transit benefit data to devices.

The Contractor shall be responsible for the delivery of all system hardware including faregate cabinets, station terminals, and station manager portable devices, central system hardware or modifications, and all connecting cables, tools and equipment needed to deliver and install the system. Offerors have the option of proposing multiple faregate solutions for consideration as part of this procurement.

The Contractor shall be responsible for the deployment of faregates and all supporting systems at rail stations and other WMATA facilities. This includes the storage of new equipment and the removal of current faregates. The Contractor shall also be responsible for infrastructure modifications as described in Section 4 needed to deploy equipment within the WMATA environment and station existing conditions.

In preparation for this effort WMATA has verified that all current faregates have consistent power and that there is an Ethernet cable that extends from each faregate cabinet to a panel inside the kiosk. Each kiosk will be equipped with data switch and connectivity to

WMATA's communication network. Metrorail existing conditions are further described in section 1.1.3.

The Contractor shall be responsible for training WMATA's front line employee trainers, maintenance technicians, and back end system users. The Contractor shall provide all system maintenance until 90 days after the last device is installed. The Contractor shall also provide a one year warranty on parts and equipment and five years of software maintenance. This warranty period will begin after the 90 day parts and maintenance period ends.

Additionally, at WMATA's request (as a contract option) the Contractor shall provide continuing faregate maintenance services for up to 5 years after system delivery.

1.1.1 WMATA Fare Structure and Current Payment Application

WMATA Metrorail fare structure distance based fare structure varies based on time of day and day of week or user categories. The current fare system supports both bus and rail fare payments and supports adaptable fare discounts and payment sharing for bus and rail transfers as well as inter-jurisdictional transfers and cost sharing. The current system also supports multiple pass products and zone restrictions. WMATA's current fare tariff, Number 38, is publically available using this URL:

https://www.wmata.com/about/records/public_docs/upload/Tariff-on-Fares-Annotated-2-12-18.pdf

In conjunction with Tariff #38, the Ridership Rules and Guidelines are available using this URL:

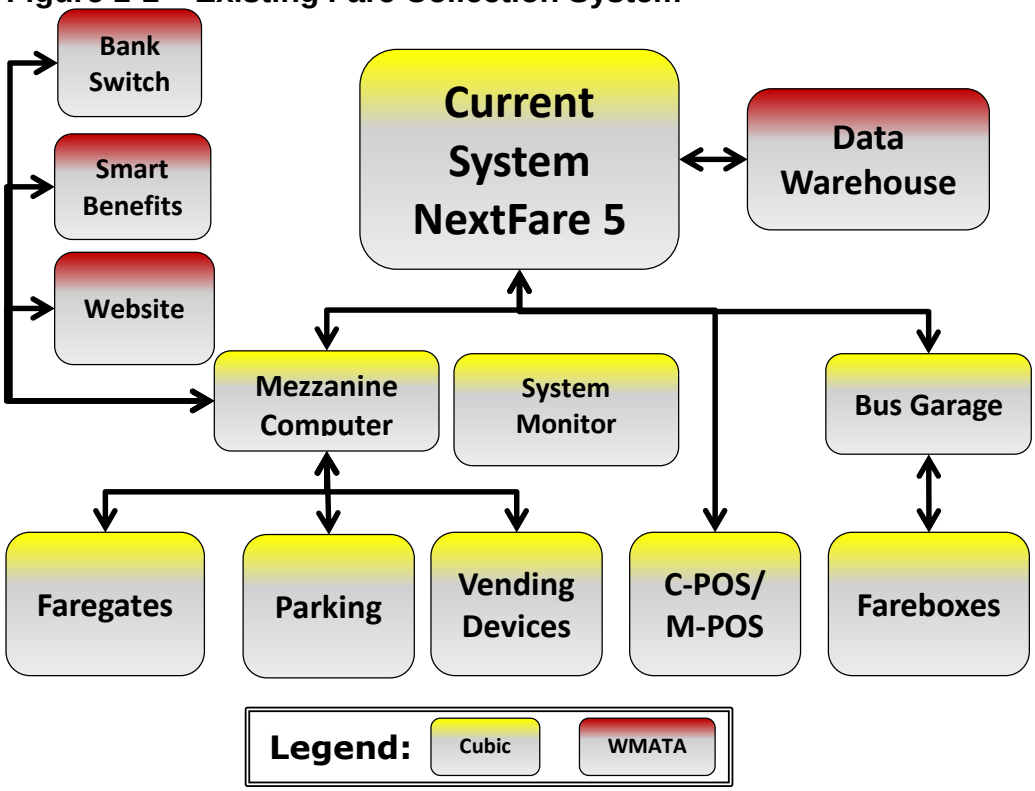
https://www.wmata.com/about/records/public_docs/upload/Tariff-Ridership-Rules-6-21-17.pdf

WMATA's Metrorail fare structure is part of an integrated regional fare platform that provides seamless fare payment and transfer across 8 transit operators in the National Capital Region.

WMATA currently operates an electronic Automated Fare Collection (AFC) system based on Cubic-supplied Nextfare® 5 software and hardware. This system operates the faregates, fare vending devices, and other pieces of equipment that utilize contactless media for fare payment and employee identification.

WMATA's automated fare collection system architecture is depicted in Figure 1.1.

Figure 1-1 – Existing Fare Collection System



WMATA's fare system is comprised of systems that are part of the Nextfare® 5 platform and systems that interface with the current system to support fare payment and device management. Ridership and payment data is compiled by the current system and is stored to the WMATA Data Warehouse, where most of WMATA's routine operational reports are generated. The current system also supports a system monitoring application that allows authorized users to monitor the operating status and key event data of Metrorail devices and centrally control faregates.

WMATA's current system supports list services to identify fare media that is reported as lost or stolen. These "hot list" are uploaded to device payment targets to restrict access. WMATA's fare application also supports web sales, employer transit benefits and other customer service account management transactions. These transactions loaded to local devices and written to customers registered fare media via the payment target.

1.1.2 WMATA Fare Media

WMATA is currently operating MiFare Plus-based contactless smart cards that are configured with a Cubic security application. WMATA may advance to the MiFare DESfire platform in the future, as well as implement a mobile app. The mobile fare payment platform will work with WMATA's existing infrastructure, allowing customers to tap their mobile device to the card readers on the faregate. The payment process is designed to be seamless and will have a similar experience to tapping a SmarTrip card today. Using the app, customers will be able to check fares, get real-time service information, and add money to their SmarTrip account instantly through Auto-Reload when the value is low.

1.1.3 Existing Conditions

Faregate replacement must take into consideration existing station conditions and implementation plans must take into account the constraints of WMATA's existing infrastructure. Existing conditions that could impact faregate deployment include:

- physical conditions at stations;
- existing communications and data network;
- existing power circuits; and
- location, size and equipment of facilities that support and maintain the existing fare system.

Mezzanine layouts and supporting power and communication infrastructure vary across the system, but faregate power and data raceways are typically configured in the same way. Current faregates have incorporated within its housing a two-position power switch, which are used to power down and power up the faregate. Each faregate cabinet except the fare end cabinet has two electrical receptacles. Each faregate has incorporated within its housing a two-position power switch, which shall be used to power down and power up the faregate. WMATA requires faregates to be powered from individual power receptacles, have power switch, and provide emergency lighting that is powered from emergency power source.
The power loads for current faregate equipment is as follows:

	Idle w/Heater Off	**Idle w/Heater On**	**Initializing w/Heater On**
Standard Faregate	**1.28 A (153.6 WATTS)**	**4.28 A (513.6 WATTS)**	**6.32 A (758.4 WATTS)**
ADA Faregate	**1.35 A (162 WATTS)**	**4.35 A (522 WATTS)**	**6.32 A (758.4 WATTS)**

Current faregates data cabling includes a single home run cable twisted pair cable from each faregate cabinet to the Station Operator Computer (SOC) and multiple interconnect cables between faregate cabinets that are connected by an underfloor duct that runs the

length of the array. Both the electrical and data underfloor duct run under the foot print of the faregates and cabling is accessed with stub up connectors.

WMATA has undertaken a program to inspect faregate ducts, and in some instances, the power and/or data underfloor duct has sections that are damaged. In those cases a second underfloor duct has been installed outside the foot print faregate and rigid conduit is installed between the duct and the faregate to support data cabling. This will impact the interconnect cable length requirements where this outside duct is needed.

Each current faregate cabinet has a single Ethernet cable that is connected to a patch panel under the kiosk. The patch panel is connected to a switch that links AFC equipment to WMATA's MetroNet fiber network. Metrorail mezzanines are equipped with Wi-Fi access points which can be leveraged to support mobile devices as long as interfaces conform to WMATA security guidelines.

Current faregates interface with the station emergency alarm system via the fare system SOC which is housed inside the kiosk. The SOC supports an emergency alarm delay application that helps to prevent false alarms from automatically opening faregates. The SOC also connects fare system to the central data system via WMATA's MetroNet and supports localized fare system applications include opening faregates and assessing fare media anomalies.

Some Metrorail stations have mini-mezzanines that are in a location away from the kiosk and in some instances on the station platform level (train level). The data cabling to these devices in some instances have fiber optic cable and data convertors to connect fare devices to the kiosk SOC. Deployment of replacement faregates to these mini-mezzanines may require specialized access and confined place certified technicians.

Additionally, there are a few stations (not more than 12 mezzanines that are not accessible by elevator. Special lifts with weight restrictions will be needed to move equipment and materials using station escalators.

Faregate deployments will have to adapt to these existing conditions. Deployment planning must include provisions to work within the constraints of station conditions and infrastructure. If faregate delivery cannot be adapted, deployment planning will need to include provisions for special riggers to deliver equipment from special trains and lift them to station platforms.

1.1.4 Constraints

The principle project constraints are:

- Interfacing with WMATA's current fare payment system
- Working closely with the Systems Integrator in the design, testing and implementation of systems.
- Coordinating with Systems Integrator in installing and interfacing Tri-Reader 4 in faregates.

- Coordinating with Systems Integrator in installing and interfacing Payment Validators to the Station Monitor.
- Meeting aesthetic requirements to be complimentary to station's historical design which have landmark protections;
- Deploying equipment within WMATA's existing power and communication raceways and interfaces;
- Interfacing with station emergency alarm system; and
- Deploying equipment without disrupting revenue service or creating transition issues for WMATA's customers.
- Deploying equipment that provides conformity to all current ADA requirements.
- Although newly deployed equipment does not have to match the current equipment's height dimension, the deployed solution must conform to the latest NFPA 130 standards.

WMATA is not replacing its current back-end operating software system or payment application with this initiative. Therefore, the faregate delivery must include implementing an interface with Cubic Nextfare® 5 software and Cubic payment processing targets PPT or alternative payment target that is adapted to support WMATA's current fare media. Currently, the Cubic payment targets store the fare system security encryption keys WMATA's SmarTrip cards interface with the Payment Target with a Cubic application. For this procurement, the Systems Integrator shall provide the Cubic Tri-Reader 4 (TR4) for installation within the faregates as well as Read Only Payment Validators that shall be installed in the stations that shall provide customer service functions.

Many of WMATA's Metrorail stations are considered historical landmarks and changes to the stations are subject to review by regional historical groups. The introduction of new gates must take into consideration impacts on the historical aesthetics of the location. Faregate finishing should include accents that are complementary this aesthetic.

Faregates overall footprint shall match (or closely match) the current faregates to ensure compliance with ADA and be complementary to the historic visual appearance of the originally designed faregates array. The faregate height need not match the height of the current faregates, however, the solution much comply with current NFPA 130 and all other applicable standards and regulations. Metrorail station mezzanines power and communication are supported by three under floor ducts (communication, main power, and emergency power). Conduit stub-ups bring wires and cables from the kiosk to each faregate. Faregates that introduce a different foot print will have to mitigate adjustments to power and communication infrastructure. Current faregate cabinets have a width of 11 inches, regular aisles are 22 inches, and ADA aisles are 36 inches.

Current faregates are powered by two 120 volt twist lock power receptacles (one supports faregate primary power needs and the second is connected to WMATA's station emergency power and supports emergency barrier opening and emergency lighting). WMATA's safety regulations requires faregate maintainers to be able to disconnect faregates from station power. The twist lock receptacles reduce the risk of faregates

losing power. The stub-ups and power receptacles typically sit about 4 inches above the floor and the location of the stub-up vary within the faregate. Faregate deployments will have to adapt to WMATA's site conditions.

Faregates support emergency egress and the barriers must open on conditions of loss of power, detection of power fault, or the activation of WMATA's emergency alarm system. The emergency alarm system is activated when a fire alarm condition is detected within a station. The emergency alarm system sends a voltage to the current station SOC, which is equipped to handle a voltage in the range of 3 to 30 volts a/c or dc. The SOC in turn sends an "Open all Barriers" signal to all faregates. This open command is sent over the current communication lines from the SOC to the faregates. The SOC also supports a 45 second delay and alarm override for those instances in which a false alarm is activated.

The new faregate local controller must be able to constantly monitor the state of the station emergency alarm system signal and be able to send the "Open All Barriers" signal to all faregates, when a voltage in the range of 3 to 30 volts a/c or dc is detected from the emergency alarm system. The new faregate local controller must also be adaptable to a change in WMATA's emergency protocol and be able to be configured so that it will activate the "Open all Barriers" signal when it senses the absence of a voltage as opposed to the sensing of a voltage from the emergency alarm system.

New faregates must be deployed without impacting revenue service. Faregate deployment in most instances will be done during the third shift and all deployment tasks that impact customer egress and ingress must start of Metrorail stations close and be completed and fully operational before the station opens. At WMATA's discretion, some daytime installations may be scheduled. In the event it is necessary to reduce emergency egress below acceptable levels, Fire Watch Protection must be put in place. Metrorail deployments require escort support from WMATA personnel. Contractors should assume that WMATA will support deployment in up to three station mezzanines per night.

1.2 Qualifications

Offerors must have demonstrated experience delivering AFC solutions of similar size and complexity for rail environments. Offerors teams must include demonstrated experience in faregate design and manufacturing, AFC systems integration, program management, training, hardware installation, and maintenance.

Offeror teams must also comprise professional experience and expertise to meet all project requirements. Teams must provide an organizational structure and team qualifications that demonstrate the ability to implement and manage all aspects of the contract.
Key staff requirements and their minimum qualifications include:

- Project Manager – The Project Manager must have a minimum 15 years professional experience, demonstrated AFC systems experience, and at least 5 of those 15 years should be as a project management experience.
- Quality Manager – The Quality Manager must have a minimum 15 years professional experience and at least 5 years of quality management experience. The Quality Manager must not directly report to the Project Manager. The Quality Manager should be independent of the Project Manager.
- Technical Solution Manager – The Technical Solution Manager must have a minimum 10 years professional experience and demonstrated expertise in delivery complex system solutions. The Technical Solution Manager must have expertise in AFC systems, software development, and systems integration and testing.
- Deployment Manager – The Deployment Manager must have a minimum 10 years of experience in systems installation and related construction expertise. The Deployment Manager must have demonstrated knowledge of electrical and communication infrastructure, OSHA standards, and construction scheduling and management.
- Deployment Quality Manager – The Deployment Quality Manager must have at least 15 years of construction and systems installation experience. The Quality Manager must have at least 10 years construction or installation related experience.
- Training Manager – The Training Manager must have at least 7 years of experience in designing and implementing technology training programs and materials.
- Maintenance Manager – The Maintenance Manager must be an experienced technician with at least 7 years of experience repairing and maintaining complex technological equipment and systems. The Maintenance Manager must also be fully training and certified in maintaining proposed faregate equipment.

Staffing changes for the Project Manager and Maintenance Manager positions must be approved by WMATA.

1.3 Technical Proposal Requirements

Technical proposals must demonstrate that the Offeror understands the project technical requirements and implementation constraints and will deliver a technical solution that meets WMATA's needs. The table below outlines the specific proposal requirements for each evaluation criteria.

Section	Evaluation Components	Proposal Requirement
Technical Approach	Adherence to Technical Requirements	A completed compliance matrix with responses to specific design and implementation requirements.
	Responsiveness to WMATA Core Objectives	A narrative that describes how the proposed solution addresses WMATA's key project objectives, including: • Modernize WMATA's faregates; • Improve the customer experience; • Improve operational interfaces; • Increase faregate reliability; • Reduce opportunity for fare evasion; • Reduce power consumption; • Provide a pleasing design that is complementary to WMATA's historic design aesthetic; and • Solution works with the current fare payment application.
	Project Organization	A description of the proposed team, roles and responsibilities of sub-contractors and key team members and a project organization chart depicting the relationships between key staff and sub-contractors if applicable.
	Schedule	A project schedule that includes anticipated durations for each line item in the pricing sheet as well as key deliverables. Project schedule should confirm compliance with project milestones and illustrate tasks dependencies and durations. Deployment task details should be described on the deployment approach.
	Systems Integration	Confirmation that the project delivery will meet systems integration requirements and incorporate Cubic-supplied payment processing terminals and payment validators into the technical solution.
	Equipment data sheets	Data sheets for proposed faregates, station terminals, portable devices and any system peripherals (these may be included in an appendix).
Deployment	Deployment Approach	A description of the deployment approach. This includes a description of

Section	Evaluation Components	Proposal Requirement
		major deployment tasks, anticipated staffing levels, and approach to installing new equipment without leaving more the one faregate aisle out of service. The deployment approach shall also describe faregate compatibility with WMATA infrastructure and identify any special adaptations that will be needed to install faregates in Metrorail mezzanines. Should the deployment tasks include the repositioning of electrical receptacles, the deployment description should verify that deployment teams will include licensed electricians.
Design Aesthetic	Faregate Design and Finish	Images of proposed faregate structure, finish, and coloring. Proposals shall also describe how use of color and finishing complements WMATA's historic aesthetic and brand (supporting details may be included in an appendix).
Qualifications	Past Experience	A list of projects within the past 5 years for both the prime contractor and sub-contractors that demonstrate the experience and expertise needed to meet contract requirements. Past experience shall include the contracting agency, project descriptions, start and end dates, relevance to this project, and contact information for the contracting agency.
	Key Resumes	Resumes for key staff including: Project Manager, Quality Manager, Technical Manager, Deployment Manager, Deployment Quality Manager, Training Manager, and Maintenance Manager.
Sustainability	Reduce Power	Power load requirements for faregate and supporting devices and any power saving features or strategies included in the proposed solution.
	Other	Identify and describe any other sustainability improvement provided by the proposed system hardware or project delivery.

Section	Evaluation Components	Proposal Requirement
Maintenance Plan	Optional Maintenance Service Plan	A description of planned maintenance services, should WMATA choose to implement this contract option. The description shall confirm the Offeror's commitment and ability to establish a local presence, provide a staffing plan that demonstrates the Offeror's ability to provide and maintain the technical resources necessary to provide service coverage throughout WMATA's service area and though all WMATA's operating hours. Proposals should also include a description of bench maintenance services, and include a description of proposed approach to manage inventory, implement repairs, and document maintenance activities.
Enhanced Functionality	Additional Functionality	Descriptions of faregate and faregate system functionality that are over and above solicitation requirements and that potentially deliver improved system capabilities and/or will have a positive impact on WMATA operations, system maintenance, and customer experience and/or safety.

2 Faregate Requirements

2.1 General Requirements

The Contractor shall furnish faregates that are fully integrated with WMATA's current fare payment system. Faregates shall comply with payment security requirements and support all current WMATA fare media as well has have the functionality to support NFC (near field communication) based payment in the future.

Faregates shall be accessible to customers with disabilities and limited English proficiency. Faregates shall adhere to the accessibility guidelines of the Americans with Disabilities Act of 1990 and Title VI of the Civil Rights Act of 1964.

Faregate aisles are formed by a pair of faregates and support standard and ADA aisles.

- A standard faregate aisle, reversible in direction, with an aisle width matching the present standard aisle width of 22"; and
- An "ADA" faregate aisle that is reversible in direction and fully ADA compliant through which physically challenged Customers shall be able to pass. The width for an ADA aisle is 36" the full length of the faregate.

Both types of faregates shall operate in the same manner and providing the same functionality with the only differences being ADA specific design parameters. The faregates shall operate with or without communication to a central computer system only if there is a failure in communications. In the event that WMATA MetroNet communication in unavailable, faregates shall operate in an orphan mode. While in orphan mode, faregates shall perform all fare payment transactions and maintain local connectivity to the Station Terminal and emergency system.

Multiple faregates aligned in a row shall constitute a faregate array. Faregates shall be monitored and controlled centrally and locally. Release of faregate barriers for passage through a faregate aisle shall be controlled by the Cubic TR4 Payment Processing Target when a successful payment transaction is completed; from the station manager device when manually activated by the Station Manager; from a tactile emergency button inside the station kiosk; and, remotely from the Rail Operations Control Center (ROCC) or other authorized user workstation. Faregates shall also be interfaced with WMATA's emergency system and automatically open under emergency alarm system or power loss.

At least one ADA faregate shall be furnished and installed at each station mezzanine to permit Customers with disabilities and others who cannot use the standard faregate to move between the unpaid and paid areas of the station. It shall also serve as a service gate, emergency exit gate, and as a backup to the regular faregate array, when required.

All design submittals identified within this Section apply to all faregates needed to provide the identified faregate aisles.

Faregate PPTs shall communicate with WMATA's current fare payment application (Cubic supplied Nextfare®) for all payment transaction applications including fare tables and fare payment rules, Nextfare® central account directives for Autoload and invalid media messages. Faregates communications to the faregate central system shall interface via WMATA's wide area network.

2.2 Standards

The following standards and codes in effect at Preliminary Design Review shall be followed as applicable during the design, development, construction and installation of the system, including all components and devices. The Contractor shall also comply with all applicable Federal, state and local codes.

Government Requirements and Industry Standards
1. Americans with Disabilities Act (ADA) of 1973 2. ADA Standards for Transportation Facilities 3. ANSI/IEEE Standard 828 Standard for Software Configuration Management Plans 4. ANSI/IEEE Standard 1012 -for Software Verification and Validation 5. ANSI/IEEE 730, Standard for Software Quality Assurance Plans 6. FTA –IT-90-5001-02.1 Quality Guidelines 7. IEC-801-2 pertaining to electrostatic discharge 8. IEC 60695-11-10 1999 (Amended 2003), Fire hazard testing: part 11-10: test flames: 50 W horizontal and vertical flame test methods 9. IEC 61000-4-2, Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Electrostatic discharge immunity test 10. IEEE 802.1p Traffic Class Expediting and Dynamic Multicast Filtering 11. IEEE 802.11 n standard for wireless data communications 12. IEEE 802.11i standard for wireless data network security 13. IEEE Standard 1058, Software Project Management Plans 14. IEEE P1588 Standard for Software Documentation for Rail Equipment and Systems 15. IEC529, Definition of Protection Grades 16. ISO 9001, International Standards for Quality Management 17. ISO/IEC 10373, Identification Cards – Test Methods 18. ISO/IEC 14443 Parts 1 through 4 – Contactless Smart Card Standard 19. ISO/IEC 18092 / ECMA-340 – Near Field Communication Interface and Protocol-1 (NFCIP-1) 20. ISO 27001, Information Technology - Security Techniques - Information Security Management Systems - Requirements

Government Requirements and Industry Standards
21. MIL-STD 105, Sampling Procedures and Tables for Inspection by Attributes 22. MIL-STD-461E 23. MIL-STD-810F 24. National Electrical Code (NFPA 70) 25. National Electrical Safety Code (ANSI C2) 26. National Fire Protection Association (NFPA) 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems 27. National Fire Protection Association (NFPA) 72 – Fire Alarm Code 28. Payment Application Data Security Standard (PA-DSS) 29. Section 508 of the Rehabilitation Act of 1973 30. Society of Automotive Engineers J-1113-13 Electrostatic Discharge 31. Society of Automotive Engineers J1708, J1587, J1939 32. Society of Automotive Engineers SAE J1455 Vibration and Shock 33. Title VI of the Civil Rights Act 1964 34. Transit Communication Interface Profiles (TCIP) 35. UL 1053 Standard for Safety Ground-Fault Sensing and Relaying Equipment 36. UL 50 3R Water Ingress Test 37. UL 60950, UL Standard for Safety of Information Technology Equipment 38. UL 969 Standard for Safety Marking and Labeling Systems 39. Worldwide Interoperability for Microwave Access (WiMAX) (based on IEEE 802.16) 40. 3rd Generation Partnership Project (3GPP)'s Long Term Evolution (LTE) 41. State, county and local building, electrical and construction codes, as applicable 42. WMATA Manual of Design

Where reference is made in the Contract Documents to publications or standards issued by associations or societies, the intent shall be to specify the current edition of such publications or standards in effect on the date of Contract Award, notwithstanding any reference to a particular date or version

In the case of conflict between provisions of codes, laws, and ordinances, the more stringent requirement shall apply. The Contractor shall identify all local, state, or national codes, ordinances. WMATA's jurisdiction includes Maryland, Virginia and the District of Columbia, code and requirements must meet or exceed requirements for each jurisdiction.

Until Final Acceptance of the entire project, the Contractor shall identify all changes to all applicable codes and laws, and notifying WMATA.

2.2.1 ADA Compliance

Contractor shall furnish documentation at the Preliminary Design Review and Final Design Review of all faregate ADA certifiable items and confirm faregate design compliance with all listed design items. The Contractor shall also provide certification of ADA compliance from a qualified independent contractor at Factory Acceptance Testing stage of the project. **CDRL 2.2**
Further, ADA certifiable measures will be included in Installation Acceptance Testing plans and verified at the time of installation.

2.2.2 Title VI Compliance

Faregate messaging must comply with Title VI guidelines for customers with limited English proficiency. The faregate customer facing messages and proposed device signage shall be compiled into a document for Title VI compliance review. This will be provided as part of PDR and FDR. **CDRL 2.3**

2.3 Faregate Functionality

Faregates functionality shall include the following:

A. Provide egress and ingress control and limit customer throughput to one customer per transaction;
B. Provide continuous operation when network communications are not available;
C. Be configurable to support bi-directional egress and ingress control;
D. Provide safety controls to automatically retract barriers when obstructed to prevent injury or damage;
E. Provide sensing capability to limit customer throughput to allow only one customer per transaction and to distinguish support animals and baggage from other means of fare evasion;
F. Provide configurable visual and audible alarms to identify instances of potential fare evasion or other anomalies;
G. Issue audible messages to indicate successful payment transaction and alarms to indicate unsuccessful transaction;
H. Provide local and centralized faregate management;
I. Interface with the WMATA's emergency alarm system to automatically open barriers in an emergency alarm event;
J. Support local and system faregate controls to place faregates in and out of revenue service;
K. Support local and centralized faregate controls to adjust the directional configuration of faregate aisles;
L. Maintain error event logs, transaction counts by type, and maintenance log data and upload data to faregate central system to support system monitoring and reporting;
M. Support local and centralized system diagnostics;

N. Provide a hierarchal faregate control protocol;
O. Provide access controls and access authentication for faregate management and maintenance;
P. Provide internal registers for capturing and storing transaction data. Registers shall include but not be limited to number of patrons entry; number of patrons exit; number of student fares; number of concession fares; number of employee cards; number of entry incomplete transactions; number of exit incomplete transactions; number of entry rejects; number of exit rejects; hotlist cards detected entry; hotlist cards detected exit; number of autoloads performed. Register data shall be persistent at the faregate and be accessible from the faregate as well as the central faregate control system.
Q. Forward device status events to the central faregate system for storing and monitoring.;
R. Constantly update and forward device current status to the central faregate system;
S. Make device history data available at the central faregate system;
T. Interface with Cubic TR4 and take the appropriate action, e.g. open barrier, keep barrier closed, present relevant displays, etc. based on result of media processing by TR4;
U. Interface with Cubic TR4 and react accordingly (open barriers, keep barriers closed, present proper and relevant displays, etc.) as the TR4 process media in support of all existing and future categories of customers, including programs for specific types of customers (students, customers with disabilities, employees, etc.) fare structures and fare products;
V.
W. Quickly and efficiently respond to the result of the Cubic TR4's processing as it verifies the validity of all fare media and provide the necessary payment communication to support faregate customer interfaces;
X.
Y. Distinguish concession fare products and discounted fare media and initiate visual indicator for the transaction;
Z. Support secure commination to the faregate central system and payment application central system when communication is restored;
AA. Display transactional information to customers including balance information, valid fare media, and error or event data;
BB. Provide secure local data storage and upload data to central system to support centralized faregate monitoring and dashboard reporting;
CC. Support secure manual transfer of stored data to an approved device if needed;
DD. Provide independent connectivity to station terminal and emergency button for faregate management and emergency release;

EE. Support direct interface with WMATA emergency alarm system to automatically open all faregates upon activation; and
FF. Be equipped with ground fault interrupt safety device

2.4 Be equipped with ground fault interrupt safety device Design Requirements

Faregates shall be the result of rigorous industrial design process and constructed in a manner that is easy and intuitive to use, functional, safe, and NFPA 130 and ADA compliant. Additionally, all faregate equipment and components shall be of tamperproof design and shall facilitate easy access by authorized service and maintenance personnel yet prevent any unauthorized access to equipment components. Faregates shall be aesthetically pleasing and messaging and labels shall be highly visible and easy to understand.

Faregates finish materials shall be durable, impact and scratch resistant and available in each of the following finishes or a combination of them:

1. Baked Enamel Federal Standard 595 Color FS 20040 (Metro Brown);
2. Stainless Steel No. 4 Brushed Finish; and
3. Stainless Steel Grade 316L or better.

Faregates shall be robustly designed for non-stop continuous operation for its intended purpose in a public transportation environment and to meet the system life requirements. Industrial Designs Reviews shall be conducted throughout the design review process to ensure compatibility with the specification requirements.

2.4.1 Conceptual Design Review (CDR)

The purpose of the Conceptual Design Review (CDR) is for the Contractor to seek the Authority's early agreement on the approach to the design. The CDR shall be based on and be consistent with this Specification and the Contractor's Final Proposal Revision. It shall provide such additional details as necessary to fully present the design approach, to eliminate ambiguities, and to narrow alternatives as system vendors are selected. The CDR shall be accomplished progressively on a system-by-system basis. Separate CDR Sessions may be scheduled as required**.** During the CDR, the vendor shall coordinate with the Systems Integrator to develop and finalize an Interface Control Document which shall detail the interface between the PPT and the faregate, including all protocols, message formats, etc. used for the interface. **CDRL 2.4** The CDR package (or packages) shall address the following topics at a minimum:

- Top-level description of the functional flow for all hardware and software requirements as proposed by the Contractor and sub-supplier(s).
- Proposed method, protocol and messaging format to be used in ICD and description of the efficacy of chosen methodology.

- Architectural view of the high-level layout including reasoning for choosing each component and design methodology
- A narrative description of each proposed device, various proposed software applications, and requirements
- Overview system block diagram
- Identification of all interfaces between the major systems and subsystems
- Proposed manufacturer technical specifications, drawings and data
- Status review of all CDRLs scheduled for delivery during this phase
- Reflect 30% of final design

2.4.2 Preliminary Design Review (PDR)

A formal Preliminary Design Review (PDR) shall be conducted to summarize progress made with the selected design approach, evaluate its adequacy, and access its compliance with the Specification. The PDR shall represent approximately 60% completion of the total engineering effort required for all the proposed materials to be supplied and shall be held at a location determined by the Authority. **CDRL 2.5** The PDR package (or packages) shall address the following topics at a minimum:

- Detailed functional interface descriptions and drawings, including mounting arrangements, installation methods, and performance requirements
- Finalized ICD design;
- Detailed proposed system designs
- Detailed sufficient maturity in the proposed design approach prior to FDR
- Proof of Concept (POC) of the design
- Proof of interoperability with other systems
- Proposed final manufacturer specifications and data for components and hardware
- List of special tools required for each subsystem
- Status review of all CDRLs scheduled for delivery during this phase
- Reflect 60% of final design

2.4.3 Final Design Review (FDR)

The Final Design Review (FDR) shall be conducted incrementally as the detailed design of each subsystem is completed, as software is finalized, and the production drawings are ready for release. The FDR shall confirm that the design of the system/subsystem under review satisfies the contract requirements. **CDRL 2.6**. The FDR package (or packages) shall address the following topics at a minimum:

- Final Design narrative

- Latest revisions of the drawings and documentation submitted for PDR
- Review the system and sub-systems specifications, test plan, product specifications
- System interface diagrams depicting all physical connections and data, signal, and power interfaces
- Established Quality Assurance plan requirements
- Technical Documentation, Manuals, Maintenance Requirements, and Parts
- Spare Parts and Life-Cycle Maintenance
- Software documentation
- Assembly drawings down to the lowest level replaceable unit
- Electrical Schematics and wiring diagram
- Inspection and test procedures
- Status review of all CDRLs scheduled for delivery during this phase
- Reflect 100% of final design

2.5 Transaction Processing

The faregate and faregate barriers shall be designed so that individuals are not able to traverse the aisles without a proper fare transaction having been completed. The standard faregate shall be able to process Customers at a minimum rate of 35 per minute for valid media transactions and support emergency egress of not less than 50 customers per minute.

Faregates shall process all acceptable WMATA SmarTrip fare media. Each time that the SmarTrip media is read by the faregate, a transaction record shall be stored by the faregate and immediacy uploaded to the legacy fare system. Faregates shall also have the capability to process WMATA issued non-SmarTrip media. The functionality to read non-SmarTrip media shall be a secure selectable option that is controlled by WMATA where transactions from this media is maintained by the faregate central system. Faregate transactions shall be processed as follows:

- When the fare media is presented to the PPT in the unpaid area to ascertain validity of the Smart Media and confirm that minimum value is available to support a fare transaction. Trip data shall be stored within PPT and written to the presented fare media;
- When the fare media is presented to the PPT in the paid area, data from the media will be used to complete the transaction and deduct the transaction value form the presented fare media. Transaction data shall be forwarded to the current fare payment application central computer for account reconciliation and fare payment data management; and

- In the instance that non SmarTrip approved WMATA media is presented to the PPT, the trip data shall be stored and written to fare media in the same manner as SmarTrip fare media, but transaction data will only be stored accounted for separately from SmarTrip transactions and uploaded to the faregate central system.

It shall be the responsibility of the Systems Integrator to have all entry and exit transaction data retained by the PPT until the data is completely and successfully transferred for central storage. Further, it shall be the Systems Integrator's responsibility to ensure that invalid fare media lists and central auto load transactions be stored locally at the PPT and shall be used to determine the validity of presented fare media, to allow or deny entry or to initiate Autoload transactions to fare media. The Systems Integrator's PPT memory shall store not less than 2 million of each list element. The faregate shall interface with the PPT and execute the proper patron-facing actions (barrier movement / non-movement and required displays, based on the results of the processing of media by the PPT).

For achieving enhanced throughput, the faregate logic shall permit a configurable number of fares (not less than five) to be banked in a single direction when fare media is used to traverse the faregate aisle. This shall be configurable by the Station. Each faregate aisle shall be capable of being set to any of the following operational modes via local or central controls:

- Active: Presents a physical barrier to impede Customer movement in both directions. Permits one entry/exit (valid fare shall be verified), in either direction;
- Free Fare: Permits entry and/or exit, no fare or fare media required;
- Intermediate: Actively controls Customer flow in one direction, while allowing free fare in the opposite direction.

The structure and layout of all transaction records shall be subject to WMATA review and approval as part of the Preliminary and Final Design Review Packages.

2.6 Faregate Operation, Control and Configuration Management

The service status and configuration settings of each faregate aisle shall be capable of being set locally at the faregate through a simple setting secured within the faregate but with the function only accessible by authorized personnel. In addition, local and central system control shall be provided to quickly set all faregates in an array to any of the operational modes.

Faregate management functions shall be executable remotely from various WMATA facilitates and locally from the station terminal or portable device.. Faregates emergency open command shall also be supported by a tactile button inside the kiosk, the station console or portable device, and by the central system that, when initiated, shall place all faregates in a mode to accommodate, through the faregate aisles, emergency egress from and prohibit access to the platform by Customers.

Failure of the faregate barriers to properly open or to fully return to the closed position, shall be sensed and reported as an alarm to the local and central system immediately upon the occurrence of such sensing. A distinct audible tone shall also sound upon this occurrence. Unique and distinct event messages shall be provided for each such failure event type.

When a faregate barrier strikes an obstruction in the aisle it shall immediately reverse and attempt another barrier closing. This shall occur until the faregate closes properly or closing has been attempted up to a WMATA-settable number of times (settable from one to 10). If the faregate fails to close after this defined number of attempts, the barriers shall remain open and the faregate shall go out of service and forward the appropriate messages to the central and local systems.

2.7 Customer Interfaces

Customer interfaces shall provide messaging to understand faregate processing of fare media, the status of the transactions and other relevant information and feedback. For this purpose, the following shall be incorporated into the faregate:

- Fixed Graphics;
- Illuminated Displays;
- Customer Display; and
- Audible Tones

Contractor shall submit the text and fixed graphics to be used for WMATA review at the Preliminary Design Review and approval at the Final Design Review.

2.7.1 Fixed Graphics

Fixed graphics shall be provided on each faregate to clearly depict and guide Customers to the locations and correct use of the PPT. Fixed graphics must be approved by WMATA as part of the Title VI review.

2.7.2 Illuminated Displays

Illuminated displays shall be provided which are easily observable and understood from each end of the faregate. Status displays shall provide information identifying the status of the faregate and adjacent aisle to the left. For these status messages one of the two following displays shall be illuminated and the other latent to indicate faregate status:

- A symbol for “Usage Prohibited” to alert the Customer not to use that particular aisle;
- A symbol for “Usage OK” to inform the Customer to use that particular aisle to enter or exit the system.

If a console goes out of service due to a malfunction which inhibits operation of barrier components that affects both aisles controlled by the console, then those aisles shall be unusable by passengers and the proper indicator display shall be illuminated.

An indicator light shall also be provided as a visual signal that reduced fare Smart Media or an invalid SmarTrip media is being used for entry or exit at the faregate aisle. This indicator light shall be installed on each end of the faregate, or as a part of the status display, facing both the paid and unpaid areas.

The indicator light shall illuminate to alert station personnel standing on both the unpaid and paid sides of the faregate array that reduced Smart Media has been used in a successful entry transaction. The indicator light shall remain lit until the faregate times out and returns to idle mode or a subsequent fare is processed.

2.7.3 Customer Displays

Variable message displays shall be provided on the top of each faregate in each direction of passage to provide information to a customer regarding faregate readiness, faregate aisle usability, transaction success or failure, and fare media status.

The Customer display shall be programmable to display various greetings and messages based on fare media validity, event occurrence and other WMATA operational needs. Preprogrammed messages shall be provided for each of the situations sensed. A utility shall be provided that will enable WMATA to remotely change the messages from the faregate central system without Contractor intervention.

The brightness of the customer display shall be automatically adjustable based on ambient light conditions.

Wording of messages to be displayed to the customers shall be defined at the Preliminary Design Review, subject to Title VI evaluation, and finalized at the Final Design Review.

2.7.4 Audible Tones

Each fare media transaction at the faregate shall result in a directed local audible tone that alerts the Customer and nearby WMATA personnel of the status of the transaction. Each transaction shall result in one of three distinct tones signifying one of the following conditions:

- Smart Media accepted, proceed through faregate;
- Smart Media not accepted, passage not permitted; or
- Reduced-fare fare media accepted, proceed through faregate.

Each tone shall be programmable for both activation (“on”, “off”) and volume levels. At a minimum, these tones shall be clearly audible and distinguishable at a distance of not less than thirty (30) feet in an unenclosed environment. Proposed tones and volumes are to be submitted to WMATA for review and approval at the Preliminary Design Review.

2.7.5 Payment Processing

The faregate PPT shall fully interface with WMATA’s current fare payment system. Communication with the current fare application central system shall be an integral

element of the faregate PPT. Communications between the faregate PPT and the current central system is required for uploading payment transaction data and for downloading fare schedules, invalid fare media lists “hot lists”, and Autoload list service transactions (web sales transactions, refunds, Smart Benefits value loads, etc.). All the foregoing shall be the responsibility of the Systems Integrator. The faregate shall interface with the PPT, and using the protocols and messaging outlined in the ICD, respond appropriately based on the results of the fare media processing performed by the PPT.

The PPT shall interface with faregate controller and customer interface applications to provide seamless interface between fare payment and faregate operational controls.
The PPT shall be integral to the faregate and shall be housed within the faregate cabinet in such a manner as to not inhibit its required read range as defined in ISO 14443 A and B communication standard and so as to facilitate part replacement with 15 minutes should the unit fail.

If the faregate PPT is unable to process fare payment that information shall be communicated across the PPT/faregate interface using the messaging format and protocols outlined in the ICD. The Customer display on the faregate shall display “Out of Service” and the “Usage Prohibited” illuminated display on the effected end of the faregate aisle shall be lit until the PPT failure has been cleared or faregate directional configuration is changed.

Each faregate aisle shall be equipped with a gigabit Ethernet switch capable of providing power via POE to all TR4s associated with that aisle. The switch shall be housed within one of the aisle’s faregate cabinets and shall connect all TR4s associated with a single aisle as well as the faregate controller to the WMATA LAN/WAN.

2.7.6 Directional Sensors

LED directional sensors shall be provided to detect the passage and direction of travel of all authorized and unauthorized Customers between the unpaid and the paid areas. Attempted and actual passage through the aisle shall trigger generation and central storage of an alarm message.

The faregate shall also be programmable by WMATA to sound an alarm at the faregate for invalid passages. The volume and duration of the alarm annunciation shall be adjustable from within the faregate, and through local and central system applications. This volume shall be individually settable by faregate aisle and the method of volume control shall be provided for WMATA review and approval at the Preliminary Design Review.

Contractor shall identify location and operation of all Customer sensors and their function to ensure proper processing at the aisle for WMATA review at the Preliminary Design Review and approval at the Final Design Review.

2.8 Control System

Each faregate shall include one or more microprocessors to control and monitor all functions of the faregate and its associated aisle. The failure of any component in any faregate shall affect only the associated faregate aisle and its controls.

Software and data uploads and downloads shall be controlled centrally. This includes updates to local system software and uploads of system data. This shall be used to facilitate faregate central operational controls and software uploads and downloads, and to down load all entry data, exit data, faregate status messages, configuration, control, and parameter information as well any additional information required by the Contractor's system to support successful operation of faregates.

There shall be no dependency on maintaining communication with the current system fare payment central system or faregate central system for normal faregate operation. If communication is interrupted, the faregate shall continue to operate in orphan mode, processing transactions and storing data locally until communication is restored.

Each faregate shall have an internally maintained calendar/clock. This shall synchronize with the current fare system central system for all time-related transaction data.
The faregate aisle and its faregates shall be able to be configured by the central system through the downloading of operational and configuration data. All functions available for each faregate and faregate aisle shall be selectable from a menu when setting up the operation of the faregate aisle or aisles.

All configuration information sets shall be saved by the central system and at the faregate. Local modifications to these settings shall be immediately communicated to the central system. Data stored at the faregate shall be stored in non-volatile memory.

The faregate shall be provided with the ability to be activated by a set of external dry contacts. Activation of the dry contacts shall simulate a complete payment fare transaction cycle (open/close barriers). The faregate shall automatically return to normal operational mode following the complete cycle. Downloading

Downloading from the current fare system payment application to the faregate PPT shall be used to:

- Synchronize the clocks;
- Download fare tables;
- Provide lists and updates of lists of invalid media;
- Download SmarTrip media Autoload transactions;
- Provide firmware updates; and
- Provide other data communication to ensure proper fare payment transactions.

All clocks shall be synchronized with the WMATA NTP (National Time Protocol) server.

The centralized interface shall be used to:

- Execute commands
- Provide updated software;
- Poll equipment for operational status;
- Provide firmware updates;
- Download changes to system and equipment parameters; and
- Provide other data communication to ensure proper operation of the faregates.

Data communications methodology and information transferrable with the central system applications and shall be identified and provided to WMATA for review at the Preliminary Design Review and approval at the Final Design Review.

2.8.1 Uploading

All transactional data shall be stored locally on the PPT and shall be transmitted to the Nextfare 5 central system in real time or near real time or upon request. Non- fare transaction data such as faregate device status events and alerts shall be immediately transmitted to the faregate central system as they occur in the faregates. Faregate audit registers shall also be stored locally in the faregate's non-volatile memory. Audit register data shall be persistent in the faregate and shall be accessed by the faregate central system in a scheduled manner or upon request.

2.8.2 Data Storage

All transaction data shall be stored in the PPT memory until it has been transferred to the Nextfare 5 central system. In the event communications cannot be established between the PPT and the Nextfare 5 central system for an extended period, data shall be retained locally on the PPT, with storage for a minimum of 100,000 Customer transactions. During such an occurrence, the PPT shall also generate and transmit to the faregate controller using the messaging and protocols outlined in the ICD, a device status event indicating that a PPT to Nextfare 5 communications error has occurred.
Audit register data shall be retained by the faregate in non-volatile memory. Audit registers shall be accessible at the faregate or from the faregate central system. Audit registers shall include but not be limited to:

- All completed transactions, which have occurred at the device;
- All incomplete transactions, including reason for rejection;
- Additional information required to provide a complete audit trail for revenues and Smart Media.

Device Status Events shall be immediately transmitted to the faregate central system as they occur in the faregate. However, the faregate shall have the ability to store locally at a minimum 100,000 device status events with time stamps. Device status events shall include but not be limited to:

Operational Data and Events

- All events and alarms sensed;
- All events and alarms cleared, including the identification of the user which cleared the alarm;
- All changes in status of the device or any module incorporated;
- All configuration changes;
- All successful communications;
- All communication failures;
- Power failures and restorations;
- All accesses to the interior of the device;
- All commands issued by the maintenance, revenue service and other personnel; and
- Additional information required to provide a complete audit trail for events and device access.

2.8.3 Pass back Control

Each PPT shall interface with the faregate as outlined in ICD to monitor all fare media usages to prevent use of any unlimited ride media products for more than one concurrent trip within a defined time period at a station. All fare media shall be verified against this pass back rule by the PPT and the PPT shall communicate to the faregate the proper action(s) to perform.

The control of the anti-pass back function shall be based on all usages and attempted usages. When this parameter is set to zero, pass back shall be deactivated and shall charge for each trip taken, regardless of the time between Smart Media taps. The pass back timer shall be configurable by smart media product and can be zero if required.

2.8.4 Servicing Display and Keypad

An internal control mechanism, consisting of a display and keypad, shall be installed in the faregate in a user-friendly location to assist troubleshooting of the faregate and for servicing, control and access needs. The display shall have a minimum of two lines, each with a minimum of 16 characters, and a minimum character height of one-quarter inch. All locally settable parameters shall be accessed and entered through the display/keypad.

Safeguards shall be employed to assure that changes to the software cannot be performed through the display/keypad. Failure codes, which shall provide diagnostic information regarding problems to a subassembly level, shall be displayed upon addressing by means of the keypad. Diagnostics shall be continuous and automatic. Requests to perform each diagnostic test shall also be possible through the display/keypad.

2.8.5 Diagnostics

The faregate shall be capable of detecting basic internal malfunctions. This malfunction detection shall cover at least failure of power circuitry, control circuitry, opening of an access panel, interface failure, and any failure of any module within the faregate.
Internal diagnostic programs shall check the faregate and its interfaces for proper performance each time it is turned on and after every maintainer login. When performance is not according to specification, the faregate shall go out of service and indicate this to the maintainer, both audibly and visually.

The detected malfunction shall be recorded in the faregate memory for transfer to the faregate central system. Any failure that occurs apart from the diagnostic check shall also be stored and transferred. When it is not possible to record the deficiency or failure, the occurrence shall be identified on the operator's display until acknowledged by the operator.
Out-of-service conditions shall be annunciated by the faregate. The information displayed shall indicate the type of failure that caused the faregate to shut down. All such messages shall be configurable by WMATA at the central system.

A visual indication shall be provided on each faregate to indicate that the faregate has suffered a major fault.

All conditions sensed shall be reviewable and have configurable priorities set by WMATA with the text used for describing these conditions by WMATA. Method for changing this text and for setting priorities shall be provided.

A push button shall be provided on the inside of the gate enclosure, away from the public and accessible by maintenance personnel when the faregate cabinet is opened. This push button shall simulate an acceptable fare transaction and cycle the faregate one time (i.e. cause the barriers to open and close in the normal mode of operation). The faregate shall provide a means for maintenance personnel to manually execute diagnostic tests of individual components within the faregate such as displays, drive motors and associated electronics. There also shall be included in the faregate a diagnostic that can be executed either by maintenance personnel at the location of the faregate, or by other authorized WMATA personnel remotely via the faregate central system, that shall check the status and serviceability of the PPT.

Diagnostic events shall be identified as exceptions and alarm messages shall be sent immediately to the central system upon occurrence. The maintenance technician must be properly signed into the device to activate this functionality.

2.9 Faregate Communication System

The contractor shall supply one POE- capable gigabit Ethernet switch per faregate aisle. The switch technical information shall be submitted to WMATA for review and approval. The PPTs associated with a single aisle and the faregate controller (SBC) for that aisle shall be connected to this switch via CAT6 cabling. All connected devices shall communicate with their respective back end systems through the switch, which shall be

attached to the WMATA LAN/WAN infrastructure. Faregate SBCs shall communicate with the faregate control system back end and the PPTs shall communicate with the Nextfare 5 back end system. The Contractor will be responsible implementing current system modifications to support this connectivity and for coordination with WMATA to establish IP addressing within WMATA's network. Faregate SBC as well as PPT communications to their controlling back end systems shall include secure authentication protocols.

In the event of loss of communication, downloading and uploading of all stored information and operational data shall be possible on a local basis for an individual faregate through the use of a compact flash RAM with a minimum capacity of 8GB. The compact flash RAM shall utilize a standard USB port.

Upon successful re-connection of network operations, all stored data (e.g., alarm, event, sales) shall be automatically transmitted to the faregate central system.

2.10 Structure and Finish Requirements

2.10.1 Faregate Cabinet

The faregate shall be constructed of stainless steel, or other revenue service proven and durable material as approved by WMATA Architecture, to meet of WMATA's Design Criteria and Standard Specifications. The baseplate of the faregate shall be of stainless steel, Grade 316L or better, as approved by WMATA.

Faregate cabinets shall be constructed with a rigid frame to which all exterior panels and interior components shall be attached. Cabinets of monocoque construction with integral structural members shall also be acceptable. Frames, panels, and doors shall be constructed with appropriate tooling that allows for complete interchangeability of all like panels, covers, and doors with consistent fits. All faregate cabinets of the same type shall have identical exterior dimensions and identical appearance.

Faregate cabinets shall have hinged doors providing direct access to all internal modules. Doors shall be equipped with devices to hold them in the fully open position. Doors on the top of the faregate shall not penetrate an adjacent faregate aisle when fully opened. Hinges shall be concealed and shall not protrude beyond the outer surface. The closing joints shall prevent unauthorized entry, as well as dirt, dust, and moisture from entering the cabinet.

The interior of the faregate cabinet shall be illuminated when the access panel is opened for maintenance. The illumination shall be provided by a commercially available and replaceable LED device(s). All cables inside the faregate cabinet shall be labeled on both ends of the cable with machine printed labels. A copy of up to date schematics and shop drawing shall be provided inside each faregate enclosure

All doors and access covers shall be secured using limited distribution Security Star/Torx bolts/screws or locks as approved by WMATA. The security Star/Torx tool/key shall be

unique to the WMATA faregate and shall not be widely available on the open market. The Contractor shall authorize WMATA to purchase additional tools/keys directly from the lock manufacturer.

Strength of equipment cabinets, including the base, shall be as identified in Section 2. Plexiglas used to cover displays, photocells and pictograms, plus the displays themselves, shall be excluded from these requirements but shall be revenue service proven.

Faregates shall be designed to provide adequate air circulation and ventilation. In addition, one or more heaters shall be provided to maintain a minimum operable temperature. These heaters shall be thermostatically controlled and automatically activate and deactivate.

Faregate shall be powered from a 120-volt duplex outlet inside the faregate cabinet. If needed emergency power shall also be powered from the 120-volt emergency power outlet. Faregate Barrier
The barrier mechanism shall accommodate high Customer volumes and shall be a bi-parting barrier or paddle barrier design. Barrier panels shall minimize potential fare evasion. There shall be no gap of greater than two (2) inches between any panel and the faregate cabinet or between two panels within the faregate aisle.

The faregate barrier shall be designed to minimize injury to customers if the faregate barrier closes on a customer. The contractor shall calculate and determine the safe closing force and ensure that the closing force does not exceed this value. This closing force analysis shall be submitted for review and approval to WMATA. Each half of the barrier shall move simultaneously. The time required for the barrier panel to move through its full path of travel shall be not more than 700ms.

Closed barriers shall be able to sustain impacts in both directions of travel without permanent deformations or damage to either the barrier or the mechanisms. The impact shall be equivalent to a 300 lb. Customer moving at 3 mph and striking the barrier at the point where both panels meet.

Upon loss of primary power, or receipt of the appropriate signal from the fire control system, the faregate shall complete all in process transactions and barriers shall automatically open, permitting –unrestricted exit from the paid area by Customers or as otherwise identified by NFPA 130 or other appropriate District, State or Federal requirement. Upon restoration of power, the faregate shall return to its normal operating state without manual intervention within not more than five (5) minutes.

The barriers shall part to provide an open aisle when a command is sent to the faregate from the Station Manager via the station terminal at the individual station mezzanine or when a command is sent from the Rail Operations Control Center (ROCC) or other WMATA remote workstation. This command shall be able to be sent to a single faregate or to all faregates in an array at the station mezzanine when issued by the Station

Manager or other authorized central user. This command shall also be able to be sent to a single faregate or to all faregates at selected stations, a particular group of stations, and system wide when issued by a Central System workstation.

If communication fails between a faregate and the Station Terminal, the Station Manager shall be able to activate a command locally within the faregate cabinet, after securely accessing the faregate cabinet to have the barriers part to provide an open aisle and remain open. Upon restoration of normal operation, the barriers shall automatically return to the closed position, prohibiting passage through the aisle without proper fare payment.

. The faregate shall be designed to accommodate the mounting of PPTs that have a diameter no less than 87 millimeters and a height of no less than 30 millimeters. PPTs shall be connected via CAT6 Ethernet cabling to a POE capable gigabit Ethernet switch which shall be supplied with the faregate. The faregate can optionally power the PPT from a DC power supply within the faregate. This supply shall be capable of providing a DC voltage in the range of 12 to 36 VDC.

2.11 ADA Faregate

The ADA faregate shall be identical to the standard faregate, operate in the same manner and provide the same reporting, sensing and functionality with the exception of the following:

- The faregate aisle shall have a minimum clear opening to meet ADA requirements.
- Six (6)PPTs shall be installed on the following locations (three in each direction of a reversible ADA faregate aisle):

  a) Top-right-side of the faregate cabinet
  b) Inner Right-side vertical face of the faregate cabinet
  c) Inner Left-side vertical face of the faregate cabinet

  The position of the right- and left-side PPT installations shall conform to the ADA requirements.

- The ADA faregate shall permit the Customer throughput to be set to accommodate from five (5) to thirty (30) Customers per minute. This shall be a parameter that is settable by WMATA from the CDS. As delivered, the ADA faregate shall provide for a throughput of not more 20 Customers per minute and not less than 15 Customers per minute.
- The faregate barrier shall have a smooth surface on both sides.
- The faregate barrier shall be of sufficient height and width to provide the necessary access and egress control between the paid and unpaid areas.
- A "wheelchair" sign shall be affixed to both ends of the faregate.

- The ADA faregate shall sense the direction of travel through the faregate aisle. The ADA faregate shall sound an audible alarm if more than one customer passage is detected when only a single passage is permitted, based on the operating rules of WMATA and as reported by the central system. The alarm shall be adjustable in duration by software control between five and thirty seconds, and should be able to be reset or temporarily disabled from a local terminal. This alarm condition shall also be transmitted to the central system.
- The ADA faregate shall sense an open condition and shall transmit a message to the central system when the faregate opening has exceeded the allowable time. The allowable time shall be adjustable in duration by software control, between one and sixty seconds. The alarm should be able to be reset or temporarily disabled from the central system Workstation. The ADA faregate shall transmit a faregate-closed message upon closure of the faregate.
- The sound level of all local alarms shall be 80 dBA minimum measured 10 feet from the barrier with adjustment possible from within the faregate or through software control. An externally accessible key switch shall be provided to deactivate the alarm. When this key is used, the appropriate alarm message shall be stored by the faregate and immediately transmitted to the CDS.
- The ADA faregate shall not require that the clamshell barrier be closed before accepting the next fare in the same direction of travel.

The design of the ADA faregate and barrier shall be approved by WMATA at the Preliminary Design Review.

Each station shall be equipped with at least one ADA faregate to suit operational requirements. Additional ADA faregates shall be installed where necessary to accommodate structural or other station configuration needs.

ADA faregates shall be capable of being installed adjacent to a wall and still provide for maintenance access. Servicing or maintenance access and activity shall not require the closing of any adjacent aisle.

The ADA faregate base shall be provided with mounting holes for securing the cabinet to the floor. Any specialized mounting devices shall be provided by the Contractor.

All ADA faregates shall be installed with WMATA-furnished power and communications connections supplied from conduit within the floor. The use of ramps or any other configuration to conceal cabling on or above the floor is prohibited.

Installation drawings and prerequisites for installation of each faregate type shall be provided to WMATA for review at the Preliminary Design Review and approval at the Final Design Review.

2.12 System Security

The Contractor shall provide WMATA with a complete, high-security method for operating and managing faregates equipment and supporting systems. The Contractor shall ensure that all system passwords shall be safeguarded and resettable under WMATA control, and that no "back doors" or means of unauthorized entry are designed into the system.

The ability to remove or add users authorized to access the faregate operational and maintenance systems shall be restricted to designated users. Additional password authorization shall be required to perform this function. At no time shall any password be displayed on any screen. The system shall interface with WMATA's central directory to maintain a current list of WMATA employees.

A system security plan shall be developed and presented as part of the preliminary and final design package. **CDRL2.7**

This system security plan shall include password systems and administration, communications security measures, operating systems and program security, and data encryption methods, and shall be submitted in conjunction with the system architecture submission.

2.13 Product Supply and Availability

Faregates and all associated components and software shall, unless more stringently specified, conform to industry standards as specified within the Sections of these Technical Specifications. Components supplied shall be based on standard products by established fare collection and financial payment industry suppliers with documented experience producing and supplying such components.
In the event that a component becomes obsolete or discontinued prior to completion of initial System implementation, the supplier shall provide the latest generation of that component.

Wherever possible, components, spare parts and supplies shall be available from two or more U. S. based suppliers, neither of whom shall be the equipment supplier or Contractor. Non-standard, prototype, obsolete or discontinued products, or components shall not be utilized. For each deployment phase, components shall be of current manufacture.

2.14 The contractor shall assume a 180-day lead time for all parts originating from the PPT manufacturer. Service Proven

Faregates shall be identical to or derived from existing designs or prototypes slated for an operating environment equal to or more severe than that which shall be experienced in WMATA`s service area. Performance in a laboratory environment is insufficient for meeting this requirement.

2.15 Fault Tolerance and Recovery

Faregates shall be designed to quickly recover from power, communications and/or software failures, automatically returning to the operating state it was in prior to the experienced fault without loss of data.

2.16 Modular Design

Faregates shall be designed with modular components, which shall permit easy field replacement of inoperative modules to quickly return the equipment to service. Repair and adjustment of modules shall be performed in shop facilities.

Faregate design shall support the “fingertip maintenance concept.” This shall provide individual modules that are fixed in unitized frames, rails, or slides with fast latching devices, captive fasteners, or other means that do not require the use of tools to remove and replace modules. Where specified, modules shall also be secured by keys or electronic locks to prevent unauthorized removal.

Modules shall be connected together with uniform control and power supply lines. Internal control and power connections shall be made via clearly identified plug-in connections. Plugs and receptacles shall be keyed to prevent a module from being inserted into the wrong receptacle. Each module shall be designed so that it can only be installed in one correct position, and that orientation shall be readily apparent to trained maintenance and servicing personnel. All sources of electrical interference shall be suppressed within the respective module to eliminate all potential EMI-generated deficiencies.

2.17 Maintenance/Test Mode

Faregates shall incorporate a test mode. In this mode, faregates shall only produce and process test Smart Media. Non-test fare media shall be unaffected but shall be reported as “invalid” both at the field device and by the Central System when used at equipment in maintenance/test mode.
When test media is processed, all functions shall be performed for that fare type, except that the transaction data shall not be included in revenue summaries but shall be separately identified. This identification shall not permit the test data to be included in the normal revenue data reports but this shall be reported separately. Test Smart Media shall be invalid and not be processed when the equipment is in the normal operating mode.

If an item of equipment is in this mode and all access doors have been closed properly, and the maintainer has not placed the equipment back in revenue service, the faregates shall automatically return to the normal operating mode after a WMATA-settable time period. This time period shall be settable from zero (0) seconds to sixty (60) minutes and changeable at the discretion of WMATA.

2.18 Human Factors

Principles of human factors engineering shall be applied throughout the design to facilitate ease of use and safety for Customers, employees, and service personnel.

Faregates shall provide Customers with displays, graphics and signage, controls and mechanisms that are simple to use, easy to understand, and conveniently located. All Customer interfaces shall be user-friendly; that is, safe, predictable, simple to use, and in accordance with other applicable human engineering principles.

Faregates shall accommodate a broad range of potential Customers. These shall include, but not be limited to, commuters, shoppers, accompanied children, occasional users traveling to and from special events, the elderly, Customers with motor and/or sensory impairments (e.g., Customers in wheelchairs, with limited dexterity, or who are hearing or sight impaired) and Customers with limited communication skills and customers with limited English proficiency.

2.19 Environmentally Friendly Design

Faregates shall be designed with an emphasis on the principles of energy efficiency, sustainable design, usage of post-consumer materials, usage of non-polluting and non-hazardous materials for manufacture, and other similar important aspects of the design, development, manufacture, implementation, and operation. Where available, high efficiency components shall be incorporated into the equipment.

Information supporting these design concepts shall be provided for WMATA understanding at each design review. This information shall include identification of specific methods to meet the important environmentally-friendly needs. Compliance with the RoHS directive shall also be provided.

Should WMATA identify suitable environmentally friendly elements and components, best efforts shall be provided by the Contractor in order to maximize these elements, without adverse impact on system deployment.

2.20 Safety

Faregates shall be free from safety hazards. Exterior surfaces shall have no sharp edges or burrs. Cabinets, consoles and other equipment housings shall have no protrusions beyond the base that could impede the progress of a Customer. Customer control and display components shall not by design present a pinching hazard.

Faregates shall be stainless steel or other revenue service proven finish, as approved by WMATA.
All interior surfaces and components with which Customers or personnel could come in contact shall also be free of sharp edges, burrs and other hazards. Throughout the interior of the machine, there shall be no pinching hazards when the modules are moved or removed, including contact with the trays and slides provided for the movement of modules.

All components shall be electrically grounded and shall prevent electrical leakage or static charge, in accordance with all local and national codes and applicable published standards. Electrical components shall have highly visible warning graphics indicating

the voltage present and other hazards. Samples of these graphics shall be included in Preliminary Design and Final Design Review packages for approval by WMATA.

2.21 Locks and Security

Faregates shall be constructed to provide maximum protection for equipment. All equipment shall be designed to be vandal resistant to the greatest extent possible, and shall not suffer damage as a result of reasonably foreseeable conditions.

The design and installation of faregates shall discourage and minimize the effects of vandalism and theft, prevent unauthorized access to the interior of the equipment, and prevent unauthorized removal of the equipment from its installed location. Several, separate levels of security access shall be provided for access to the interior of the equipment for:

A. Maintenance personnel,
B. Station managers; and
C. ROCC representatives or other operations personnel.

Access to the equipment by authorized personnel equipped with proper Employee IDs, keys and individual access code(s) shall be provided without undue delay.

Locks and their components shall be manufactured of non-corrosive material, such as brass. Once placed in normal revenue service, there shall be no corrosive effects displayed by the locks or the area surrounding these locks.

Commencing with initial implementation of faregates, all locks, keyways, and key codes shall be assigned to WMATA and shall become the exclusive property of WMATA thus giving WMATA the ability to rekey as necessary.

Faregate doors shall incorporate sensing to identify when a door, panel, or cover is opened and store an event message (with proper log on) or transmit an alarm without proper log on).

2.22 Faregate Access

Fare media issued as employee ID shall be used to identify a technician to faregates being accessed. The fare media ID shall be read and verified against an internal list, stored within the device. This list shall be updated from WMATA's active directory.. If the fare media ID is not identified on the internal list, an alarm shall be immediately sent to the central system and reported as an intrusion.

If the fare media is identified on the internal list, the technician shall enter their Personal Identification Number (PIN). The Smart Media/PIN pair shall be checked against an internally stored list for verification. This internal list shall also identify those functions for which the technician is authorized.

Verification of fare media/PIN as authentic and valid shall be performed before access to interior components of the machine is permitted without issuing an alarm. The PIN shall provide for a maximum of eight (8) characters to be entered for the PIN, and require a minimum of four (4) for a valid PIN. When fewer than the maximum number of characters are used for the PIN, leading zeros and trailing zeros shall be ignored when validating the PIN.

2.23 Useful System Life

Faregates shall be designed to provide a minimum usable life of fifteen (15) years subject to proper maintenance being performed in a timely manner.

Contractor shall also maintain availability of spare parts for faregates through the devices useful life, including upgraded components if a device or component is discontinued or declared obsolete during the system life. Such upgraded components shall be backwards compatible with other elements of the faregate. Faregates shall also be capable of incorporating technology upgrades without undue redesign of components or modules, extensive software revisions or other similar excesses.

Faregates shall be forward-compatible with a different fare payment application should WMATA choose to change its fare payment application. The parameters for faregate future compatibility with alternative fare payment applications should be described in faregate CDR, PDR and FDR design packages.

2.24 Station- and Facilities-Based Equipment

Faregates shall be installed in locations that may not be environmentally controlled. The following climatic factors shall be used as design guidelines and shall be required. The Contractor shall also advise WMATA if there are any special environmental factors to which its equipment may be sensitive that are identified below. The Contractor shall ensure that no equipment damage occurs during manufacture, storage, and shipment as a result of climatic conditions that differ from those below.

Sunlight

The equipment shall be designed to operate with a solar radiation loading of not less than 275 BTU/hr/ft^2. Some in-station equipment may be installed in glass-enclosed areas exposed to unfiltered sunlight.

Components sensitive to ultraviolet radiation shall be protected at all times, and the equipment shall be resistive to damaging effects from this type of radiation, including when the front door is open for maintenance and servicing activities.

All light-sensitive sensors shall be protected against the intrusion of light when the door is opened. Should the opening of the door cause light to activate a light-sensitive sensor, this shall not impact equipment operation or data but an event message shall be stored for each occurrence.

Environmental Contaminants

Suitable enclosures and filtering shall be provided inside the equipment for sensitive components such as printed circuit boards and memory storage devices to prevent malfunction resulting from dust particles that could be as small as 1 to 200 microns, with a maximum concentration of 0.248 mg/cubic centimeters. Where possible, positive air pressure and appropriate filtering shall be used to reduce the dust intake.

Local Climate

All station-based and facilities-based equipment shall be designed to operate reliably in the following environmental conditions, singularly and in any combination:

A	Sunlight	None to full, direct
B	Storage Temperature	-22°F to 150°F
C	Operating Temperature	0°F to 122°F
D	Thermal Shock	Up to 50°F in 2 hours
E	Relative Humidity	13% to 99% R.H., including condensation
F	Rainfall/Snowfall	Up to 6 inches rainfall/20 inches snowfall per hour (may occur simultaneously and in the worst case include wind)
G	Airborne Dust	Up to 180 micrograms per cubic meter, with iron and salt particles. Wind Speed: Up to 90 mph, any direction
H	Freezing Precipitation	Up to 3 inches per hour
I	Water/Solvents	Water spray on equipment from cleaning floors and walls, industrial cleaning solvents and standard cleaning chemicals used by WMATA, rain, mud, snow and slush will come in contact with equipment

In addition to the specific items identified above, all faregates and supporting equipment shall also operate as specified in the atmosphere commonly found in rail station environments and the WMATA service region.

Equipment enclosures shall comply with International Electrotechnical Commission Standard 529 (IEC529) to level IP34 as a minimum.

Vibration

Faregates and all supporting systems shall withstand the vibrations common to the installation environment, including proximity to both slow and fast moving Customer and freight trains. The testing for these various types of equipment shall include verification that the equipment operates properly at the completion of each of the testing cycles without modification or adjustment.

Requirements for vibration testing shall conform to EEIG 97s0665- ERTMS/ETCS Environmental Requirements, and Track Side Equipment – Vibration, in accordance with the power spectral density (PSD), Vibration: 0.23g rms, frequency range 0 to 200Hz.

Faregates shall comply with SAE J1455 for vibration.

Shock

Components, which are sources of vibration, shall be sufficiently damped to eliminate externally-audible resonance or affect the integrity of other internal components.

Requirements for shock testing shall conform to the EEIG 97s0665-ERTMS/ETCS Environmental Requirements with Operational requirements Track (line side) and track side equipment. Test requirements shall conform to the MIL-STD 810F, Method 516.5, with the following changes:

The half sine shock pulse shall have a peak value (A) of 5g and a duration (D) of 20 milliseconds. This shall be executed with all the internal components.

Faregate equipment shall comply with SAE J1455 for shock.

Electromagnetic Interference

Electrical and electronic components shall be immune to radiated electromagnetic and radio frequencies fields, conducted electromagnetic and radio frequency energy, electronic fast transients, and electrostatic discharge. Transmissions from equipment components, either radiated or conducted, shall not cause interference to other WMATA systems.

Components shall not be adversely affected by any electromagnetic frequency and shall not interfere with the transmission and reception of the following established frequencies:

A. Audio frequencies for overlay track circuits, highway crossing approach and island circuits, and electrical lock circuits;
B. Audio frequency code overlay for ATC system;
C. Signal power;
D. Cab signals;
E. Radio frequencies (MHz).

Faregates and all ancillary system operations shall not be adversely affected by the electromagnetic fields generated by the 750 Volt DC traction power system. The system shall conform to the following requirements:

A. FCC Part 15, Subpart B Class A (Conducted emissions), pertaining to conducted susceptibility;

B. FCC Part 15, Subpart B Class A (Radiated emissions), pertaining to radiated susceptibility;
C. SAE J-1113-13 pertaining to electrostatic discharge.

Rain, Moisture & Humidity

Faregates may be installed in outdoor conditions with limited protection from the elements. In addition, the equipment base can be expected to become wet and accumulate salt, mud, and moisture. The equipment shall function and not suffer any degradation of operation under these conditions.

2.25 General Electrical Requirements

Faregates components shall conform to the requirements of the National Electrical Code (NEC) and Underwriters Laboratories, Inc. (UL) and all applicable electrical codes. All equipment provided shall be UL certified and copies of these certifications shall be provided to WMATA at the completion of the First Article Test.

Faregates shall be electrically grounded, conforming to NEC requirements. All electrical infrastructure and components installed to faregates shall facilitate electrical power distribution in accordance with these Technical Specifications.

All installation activities shall proceed in stages, in accordance with the WMATA approved Installation and Deployment Schedule.

All Contractor installation activity scheduling and proposed installation drawing submittals shall be submitted in accordance with provisions of Section 4 for WMATA approval.

The electronics shall be solid state, assembled on reinforced printed circuit boards. These boards shall be modular (plug connected) and removable for inspection and/or maintenance. The components mounted on the board shall be securely soldered in place. For those items that must be easily and often removed, high quality sockets with retainers shall be used. Where electronic circuit boards are employed and where they are to be inserted and/or removed by means of board guides, they shall be provided with lifting tabs.

All major electrical/electronic subassemblies and devices shall be interconnected also by means of mating connectors with positive retention devices. All contacts and connections shall be of non-corrosive materials. Wires and multi-conductor cables shall be color coded or permanently marked to permit positive identification. It shall not be possible to improperly insert a plug-in component into a connector.

Fuses, circuit breakers, or other protective devices shall be employed to protect the electronics, motors, and other components from overload and damage. Where used, they shall be accessible without disassembly of components. Location shall permit inspection and/or replacement through normal maintenance access doors or panels.

Where required to ensure that there is no corrosion of electric terminals or connectors exposed to the environment, WMATA-approved environmentally sealed connectors shall be used. All plug-in components shall be retained with a positive force holding them in position to ensure they do not work loose with the vibration that can be expected from trains traveling through the station.

2.26 General Structural and Material Requirements

The faregates shall be constructed to meet the following structural and material requirements:

A. With the exception of bases for equipment installed in an outdoor location, all faregate external equipment shall be constructed of non-rusting stainless steel (Grade 316L) with No, 4 brush finish or other finish as approved by WMATA. FVD bases and faregate baseplates shall be constructed of Grade 316L stainless steel or better;

B. Fastenings shall be concealed wherever possible. Exposed corners shall be rounded or mitered, welded, and ground smooth. Stainless steel shall be formed around corners so that edges are folded and concealed from patrons' views when doors are closed;

C. Faregate cabinets shall be designed to form an integrated structure capable of resisting, without permanent deformation, fatigue, failure, or undue wear, and other stresses inherent in the type of service for which this equipment is intended, including remaining operational and undamaged after experiencing a kick, punch, or other impact resulting in a concentrated load of 300 pounds to one square inch to any part of the enclosure;

D. Faregates including all its installed components shall remain in operation and survive impacts resulting in loads of 1g peak with an approximate duration of 10 milliseconds along each of three mutually perpendicular axes;

E. Faregates including all its installed components shall remain in operation and survive vibration of 1 Hz to 6 Hz at acceleration of 0.1g along each of three mutually perpendicular axes;

F. Faregates shall be arranged to distribute the equipment weight over the mounting base evenly;

G. Where dissimilar metals come in contact, the joint both inside and out shall be plated or painted with an approved coating to exclude moisture from the joint, and provide a suitable insulating barrier separating the metals. Dissimilar metals are defined as those metals, which are incompatible with one another in the presence of moisture, as determined from their relative positions in the Electrochemical Series, or from test data.

2.27 Vandalism Protection

For protecting against vandalism the following requirements shall be met:

A. All latches shall be secure and robust.
B. No external screws shall be used without the written approval of WMATA. When external screws are necessary, they shall be tamperproof.
C. All fasteners used to secure equipment shall be concealed and tamperproof.
D. All hinges for the front door and external access panels shall be concealed.
E. Security locks with profile catches shall be used. All security locks shall capture and hold the key whenever the lock is open.
F. Locks and keepers shall be drill-resistant stainless steel, and be mounted flush with the outside surface of the access door.
G. The cabinet designs shall hinder any use of burglary tools.
H. All gaps between doors/access panels and the cabinet shall be consistent along each edge and shall not exceed 0.05 inches when the door/access panel is latched.
I. Reinforcement shall be provided at the positions where there is the possibility of burglary.

2.28 Software Requirements

All software and firmware shall be provided by the Contractor fully debugged and documented, with documentation to include all test plans and reports and shall include all revisions introduced up to the time of Final Acceptance. All deployed software shall be the final release version. No beta or release candidate software shall be accepted unless specifically approved by WMATA, in writing.

Where the software is a derivative based on a previous system, the Contractor shall ensure that all software patches and modifications have been applied prior to commencement of installation. Versions of third party commercially available software shall be approved at Final Design Review.

2.28.1 Operating Systems and Languages

Software may be written in a high or low-level language although high-level languages are preferred. The language, and its implementation for the selected microprocessor system, shall be commercially available in English. All languages and operating systems must have an acceptable installed base and be approved by WMATA.

All source code, including comments and development tools, shall be in English. Source code shall be well structured, modular, and clearly documented to allow easy comprehension and straightforward traceability to the Software Design Description documents. Software comments shall also include explanations of all significant memory addresses such as interrupt vectors, I/O addresses, and memory locations for RAM, ROM

and other memory devices. All source code for the faregate components and the faregate application shall be delivered to WMATA.

2.28.2 Commercially Available Software

Some software supplied under this procurement may be commercially available to a wide variety of users. Examples include operating systems supplied by chip manufacturers and database software for wayside fault analysis.

For commercially available software, software documentation requirements are limited to the original data storage/transfer media, functional and usage details, all provider manuals, and licenses required for WMATA site use. The Contractor shall incorporate training on how the software is to be used in the specific situation for which it was provided, as part of the Training Program.

2.28.3 Redundant Data

This section not used.

2.28.4 Communication

Software shall be capable of supporting operations over multiple, disparate telecommunications/data networks. The Faregate System shall include manual data access, upload, download, and backup procedures with associated data security to sustain full operations during periods of complete or partial communication outages.

2.28.5 Version Control

The Contractor shall implement a procedure for identifying the version number for each software module for WMATA to review and approve as part of the QA submission. The version control procedure shall maintain a record of the current release and each previous release, with a detailed description of each modification. As a minimum, version control shall include:

A. The automatic identification of the version number of each item of hardware and software for each device;
B. The automatic reporting of this information when any version number changes;
C. Unique, sequential version numbers for each software and hardware module.
D. A detailed description of what has been changed/modified.

At any time desired by WMATA, a report shall be able to be generated from the Central System to provide version information for any, all or selected items of equipment and systems throughout the Faregate System.

2.28.6 Configuration Management

The Contractor shall devise and implement a procedure for management of the addition, alteration, or deletion of hardware, software, or telecommunications.

It shall allow WMATA to change and test configurations before being deployed throughout the system. This method shall also allow the ability to back out and return to original software configurations.

The Contractor shall develop and maintain a Software Configuration Control Plan that describes all software and firmware that supports the fare system and continues via updates to track changes and version numbers as updates and patches are implemented. This plan shall be submitted at the Final Design Review for approval by WMATA. The Contractor shall include in the plan a database system capable of maintaining the history of all software and status changes making it possible to determine which versions currently resides in which equipment. **CDRL 2-8**
All software shall be identified by a name, part number and a version number. The name shall identify the equipment into which the software is installed. Every change to software shall be reflected in an update to the version number.

2.28.7 Software Documentation

For non-commercially available software, thorough and accurate software documentation submittals and WMATA approval of these submittals are required. WMATA shall be provided with sufficient documentation to fully comprehend and analyze the operation of the equipment in which the software is to be installed; and to enable WMATA to maintain and modify the software to correct problems, adapt it to changing requirements, add features, and port it to a new hardware platform.

All software documentation from all suppliers shall be in a common format. This format shall use a consistent set of graphic and texts (techniques, formatting) to fully describe the software functionality and implementation. Software documentation shall include interface protocols and definitions of message structure. Software documental shall also include documentation of final software configuration**. CDRL 2.9**

2.28.8 Testability

All features and functions of software systems shall be testable on a systems level. Specific approval by WMATA is required for any feature, which is not testable on a systems level. For features, which are only testable with special equipment, all such equipment shall be supplied by the Contractor as test equipment, and become the property of WMATA. This equipment shall provide the logic, sequencing, and emulation necessary to verify that the software functions as intended. All software utilities and test tools developed for testing and/or performance measurement shall be provided to WMATA with appropriate documentation.

Type tests of all processor systems shall verify the proper operation of all software features, including diagnostics.

All Test Plans and Procedures shall be submitted for approval prior to conducting the tests in accordance to requirements in Section 4**.**

2.28.9 Software Updates

All faregates and supporting equipment and systems shall be able to accept software revisions/updates downloaded from the Central System through the applicable data exchange process. All processes for downloading software shall be reviewed and approved by WMATA at PDR. **CDRL 2-10**

When the download is complete and the equipment has acknowledged the receipt of the download, the Central System shall indicate in its database that the update has been completed. Attempts to install an update shall only be performed after the complete software has been received and accepted by faregates or supporting equipment and systems. Incomplete updates shall be retained by the equipment and upon a retry of data upload to the device, the update shall resume from the point of communication interruption.

2.29 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 2-2	ADA Certifiable Items Assessment	2.4.1	FDR	Yes
CDRL 2-3	Title VI Compliance Assessment	2.4.2	FDR	Yes
CDRL 2-4	Conceptual Design Package	2.5.1	NTP + 60	Yes
CDRL 2-5	Preliminary Design Package	2.5.2	NTP + 114	Yes
CDRL 2-6	Final Design Package	2.5.3	NTP + 154	Yes
CDRL 2-7	System Security Plan	2.12	NTP + 154	No
CDRL 2-8	Software Configuration Control Plan	2.29.1.6	FDR	Yes
CDRL 2-9	Software Documentation	2.29.2	FDR	Yes
CDRL 2-10	Processes for downloading software updates	2.3.20	PDR, FDR	Yes

End of Section 2

3 Station Terminal and Portable Station Manager Devices

3.1 General Requirements

Faregates will be supported locally by station terminals that supports local faregate control and supports a Station Manager override of the emergency alarm system and portable station manager devices that supports faregate management and customer support services from multiple locations within the station mezzanine via the station's MetroNet Wi-Fi.

Both devices shall be comprised of commercially available electronic devices and the portable devices shall be equipped with protective casings that provide protection from predictable environmental impacts.

Devices shall be delivered with all necessary attachments and auxiliary equipment to support power, battery charging and secure communication connectivity.

3.2 Functional Requirements

3.2.1 Station Terminal

A. Secure log-in and authentication for authorized users and communication interfaces;
B. Faregate configuration control to place faregates in and out of revenue service;
C. Faregate configuration management to select entry/exit configuration for each faregate;
D. Faregate commands to open or close faregate barriers individually, by array or by station; and
E. Faregate commands to control alarms, adjust lightings and activate and deactivate concession fare indicator lights;
F. Support fare configurable emergency alarm delay and override to prevent faregates from opening when a false alarm is initiated;
G. Data management to track log-on and log-off tasks; error messages; device status; and
H. Secure connectivity to faregate independent of WMATA WAN Networks.

3.2.2 Portable Station Manager Device

Portable station manager devices shall have software and hardware to enable the following functionality:

A. Secure log-in and authentication for authorized users and communication interfaces;
B. ;

C. Faregate configuration control to place faregates in and out of revenue service;
D. Faregate configuration management to select entry/exit configuration for each faregate;
E. Faregate commands to open or close faregate barriers individually, by array or by station; and
F. Data management to track log-on and log-off tasks; error messages; and device status.
G. Secure Wi-Fi connectivity to WMATA's MetroNet station Wi-Fi; and
H. Initial battery life of at least10 hours.

The functional description and concept of operations for the station manager terminal portable station manager devices shall be provided at Conceptual Design Review. **CDRL 3-1**

The hardware design, faregate management and fare media application functionality and user interface displays, operating system and application software documentation shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 3-2**

3.3 Device Requirements

3.3.1 Station Terminal

Station terminals shall be compact computers with touch screen displays and keyboard to support secure log-in, faregate management applications, and dashboard displays of device events and transactions. Station terminals shall also interface with the Payment Validators (PV) within the station such that when media is read and analyzed at the PVs, the same information shall be made available and displayed at the station terminal.

3.3.2 Portable Station Manager Device

Portable station manager devices shall be similar to that of a typical electronic device shall weigh about 16oz ounces, including batteries. The protective casing shall be designed to support easy hand held use and minimizes impacts of predictable hazards including falling to the ground, contact with hard surfaces and minor spills.

3.3.2.1 Case and Ruggedness

The portable station manager device shall be designed and engineered to protect the device against drops, shocks, spills, vibration, dust, liquid and more. The device shall be tested against MIL-Std-810G and IP-67 standards. A multi-function rotatable hand straps shall be included and office docks

3.3.2.2 Operating System

The Portable Station Manager Device shall utilize a handheld or mobile operating system such as:

- Windows Phone 10 (or later);
- Android 8.0 (or later); or
- iOS 11 (or later)

The version of the operating system that is utilized shall be the one most recently released for commercial use. Alternatively, the version may be an earlier one released for commercial use within the last two years and revenue-proven to be a stable platform for its intended use.

3.3.2.3 Processor and Memory

The device shall have a minimum processing capability of an i5. The device shall contain a minimum of 1 GB RAM and no less than 1 GB of Flash memory. The device shall contain one or more expansion slots to accommodate a Secure Digital High Capacity (SDHC) expansion media card.

3.3.2.4 Applications

The device shall include applications to control monitor faregates. Faregate control applications shall include placing faregates in and out of service, changing the entry/exit directional configuration of faregates, opening and closing faregate, and monitoring faregate alarms and events.

Portable devices shall also be configured so that additional WMATA approved applications can be stored and operated from the devices. This may include WMATA's ride-guide and next bus applications, commercially available applications, or newly developed applications.

Devices shall also be equipped with user authentication and log-in applications and device authentication applications to support system interfaces.

3.3.2.5 Display

The display shall be a color touch-screen (capacitive) display measuring at least 7 inch (diagonal). The display shall supply a minimum resolution of 1280 x 800 pixels.

The surface of the touch-screen display shall be a durable, scratch-resistant material that shall withstand daily continuous taps and strokes from a stylus or user fingertip from normal usage, over the life span of the device, without the need for replacement of the touch-screen.

The display shall provide users with instructions, prompts, and transactional information. The display shall meet the following minimum requirements:

- The display shall be easily read under all conditions of ambient light throughout the day and night. If necessary, a backlight shall be provided.

- Displayed messages shall be easily modifiable by WMATA once the system is in operation.

3.3.2.6 Batteries

The device shall be capable of operating for no less than ten (10) continuous hours on a single charge of the internal battery, with the media processor and any backlight activated no less than 50% of the time. Device batteries shall be commercially available and replaceable by WMATA.
When the device has been inactive for a WMATA-configurable period (initially set to 5 minutes), it shall revert to a sleep mode requiring depression of a designated key to activate the unit. User logon shall not be again required if the portable device is in sleep mode as described below.

Once the device has reverted to sleep mode, after a WMATA-adjustable period in that mode (initially set to 30 minutes), the device shall shut down completely, and shall require the user to log on after power is restored.

The device shall provide visual indication to inform the Operator of a low battery condition. This indicator shall illuminate when less than 15% of power remains. To conserve power, the activation of the battery low indication shall be a parameter settable by WMATA.

3.4 Communications

The device shall communicate with the backend to suit the needs of the WMATA. This shall include, as a minimum, communication via:

- Local Wireless System (MetroNet Wi-Fi).
- Local Area Network (MetroNet LAN)

The device shall be equipped to handle communications with either system at any time. In the event that both systems are available concurrently, the Portable Station Manager Device shall automatically defer to communication on the Local Wireless System. The Contractor will work with WMATA to establish the configuration of devices for MetroNet connectivity.

In the event of loss of communication, downloading and uploading of all stored information and operational data shall be possible on a local basis for an individual device through manual insertion in the expansion slot of a compact flash RAM with a minimum capacity of 8GB.

3.5 Device Security

Devices shall not be operational until a proper logon has been made to the device by a valid user.
To activate the portable station manager device for use, the user shall logon to the device with, as a minimum, a username, and password. WMATA IT deploys Absolute DDS security on its portable assets. During design reviews, the contractor shall work with WMATA IT prior to the acquisition and delivery of the PSMGC devices, who will supply

the configuration details for ensuring that the equipment supplied by the contractor has Absolute DDS security enabled on the PSMGC all devices.

3.5.1 Log-on

The device shall remain inactive and unable to perform any functions unless a proper logon has been completed as follows:

- The user will enter their unique user ID, a minimum of 6 characters, and press the “ENTER” key. The device shall display the entered user ID. The device shall then display “Password.”
- The user will enter their unique password, a minimum of 6 characters, and press the “ENTER” key. The device shall not display the typed characters of the password, but shall display only symbols in place of the actual characters entered.
- If the combined user ID and password is invalid, then the device shall display "Invalid logon" on the first line of the display and “User ID” with prompt, on the second and third lines of the display. This process shall be repeated until a valid user ID and password combination is entered or three attempts have been made. After the third unsuccessful attempt, the device shall not permit logon until it has been reset by an authorized user via communication with the backend.

A transaction record shall be stored for each successful logon, and each unsuccessful logon.

3.5.2 Log-off

The following log-off procedure shall be used by the Operator:

- The user shall press the appropriate log-off key or key combination. The device shall display “Log-Off?” and a prompt.
- The user shall enter “Y” and press the “ENTER” key.
- The device shall close all files and deactivate itself.

A transaction record shall be stored for each successful log-off and aborted log-off. Automatic log off shall also occur prior to the data transfer process with the backend as well as after a WMATA-definable time period of no activity of from one minute to eight hours.

3.5.3 Device Administration

All user level administrative functions on the device shall be executed only when an administrative level user name and password have been entered and authenticated by the backend.

3.5.4 Data Entry and Storage

The device shall not operate without the memory module properly installed. Each record shall incorporate a unique number and shall be date/time stamped. Each record shall be stored in the device memory for transfer to the backend. Data shall be stored for alarms and events, incidents of status change, data communication incidents and inspector logons and log-offs.

Data to be stored and transferred to the backend by the device shall include as a minimum:

- All events and alarms sensed;
- All events and alarms cleared, including the identification of the user which cleared the alarm;
- All changes in status of the device or any module incorporated;
- All log-in and log off for the system; and
- All configuration changes.

3.6 Reporting

In reports provided with the mobile applications, the central system shall generate reports upon request by the user. The central system shall be able to produce the following types of reports to support the operation of the fare collection. All reports shall be uniquely serialized.

- Maintenance Report – A listing of all maintenance issues, which have arisen since maintenance was last performed for the device. This listing shall also include "count to date" of the number of occurrences of each type recorded by the device.
- Supervisor Report – A listing of all users who have logged on to the device. This will also include logon failures and other similar transactions.

A minimum of five additional reports shall be provided by the Contractor, as defined by WMATA at the completion of the First Article Test.

The Contractor shall provide samples of these reports for WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 3-3**

3.7 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 3-1	Provide device conceptual description and drawings	3.2	CDR	Yes

CDRL No.	Description	Section	Due	Approval Required
CDRL 3-2	Provide hardware and software design, the functions	3.2	PDR, FDR	Yes
CDRL 3-3	Sample reports	3.3	PDR, FDR	Yes

End of Section 3

4 Testing

4.1 Faregate Test Program

The objective of the Test Program is to ensure that all hardware, software, interfaces, supporting equipment, and other system elements furnished under this Contract meet all specified requirements within this document. The Contractor, in conjunction with the System Integrator, shall conduct all testing and maintain responsibility for satisfactory completion of the testing and system implementation. The systems integrator shall supply two testing tools. One of these shall be used to test the interface between the PPT and the faregate, monitoring, recording and displaying this traffic to validate that the messaging in both directions conforms to the ICD. The second test tool shall be a Nextfare 5 simulator, a tool that will mimic the actions of a full NextFare 5 back end. It shall be used to create a testing environment for the faregates when an actual full Nextfare 5 system is not present. This tool shall be used by the contractor during FAT.
WMATA and/or its designated representatives will witness any and all tests, as determined by WMATA. WMATA and/or its representatives may, at any time during the duration of this contract, perform additional testing as determined by WMATA.

4.1.1 Test Methodology

The Contractor shall plan, perform, monitor, and document all tests described herein. These tests shall be designed to document, verify, and prove that the requirements for faregates and system integration with current fare payment systems. No testing by the Contractor or any Party or Agent acting on behalf of the Contractor shall commence until all design documentation affecting the respective equipment and relevant to the stage of the design has been reviewed and approved by WMATA, and WMATA has reviewed and accepted all related testing procedures and documents as defined here.

Testing and verification of the operation and functionality of the faregates shall commence using First Articles and production-ready versions of software, all of which shall be based on the final design of the system as agreed upon and documented from the Final Design Review meetings.

4.1.2 Test Program Plan

The Contractor shall develop and submit a comprehensive test program plan for WMATA's review and approval. As part of this plan, the Contractor shall prepare applicable procedures, which shall govern the conduct of activity, surveillance, direction, and methods of observing and recording the pertinent data including handling of failures of equipment and inaccuracies of reports. The following elements at a minimum shall be included in the Test Plan for each of the tests required:

A. Tests to be performed up to Final Acceptance;
B. Sequence of tests and, for each test, test prerequisites;
C. Identification of the Contractor's personnel to be involved in each test and a summary of their qualifications and duties;
D. Identification of the support, calibration instrumentation, test equipment and tools to be used for each test;

E. Technical publications and standards referenced;
F. Spares and consumables available for utilization during the testing;
G. Location of each test;
H. Staffing levels for maintenance and other personnel available during the testing, including a schedule;
I. Specific data to be collected during the test;
J. Test report format, including the method for reporting and summarizing the test results;
K. Method and format of record keeping for the failures identified during the testing; and
L. Corrective action procedures to be followed when failures and inaccuracies occur.

This test program plan shall be submitted to WMATA at the Preliminary Design Review and must be approved by WMATA prior to submittal of any test procedures specified within this Section. **CDRL 4-1**

4.1.3 Test Waiver Requests

At WMATA's sole discretion, portions of the Environmental tests may be waived upon written request from the Contractor **CDRL 4-2** based on the waiver providing sufficient supporting information to demonstrate that:

A. The equipment has previously passed similar tests;
B. The equipment in the test documentation provides all the same functions as WMATA system;
C. The operating environment is substantially similar to WMATA environment;
D. Test documentation provided is from a certified testing lab.;
E. Tests performed are identical or functionally equivalent to the required WMATA test for which the waiver is requested; and
F. The cost savings, which will be realized by WMATA if the waiver is granted.

The Contractor shall identify those tests for which waivers may be requested at the Conceptual Design Review, including all information as identified above to support the requested waiver and the time by which the waiver is to be provided to the Contractor so as not to impact implementation.

Waivers not identified at the CDR may not be requested at a later date unless they apply to new requirements. Waived tests will not constitute a change to the contract or system functionality.

4.1.4 Test Procedures

The test procedures shall be provided separately for all tests and their component tests and shall include, as a minimum, the following:

A. Objectives of test, referencing the technical requirements that are being tested;
B. Test environmental conditions with PPT targets installed;
C. Detailed descriptions of test specimens including drawings, part numbers, inspection and test records, maintenance records and calibration records;
D. Detailed procedures of each test and test element;
E. Personnel (Contractor and WMATA) required for performing the test, and their duties;
F. Test equipment to be used. Include any measuring equipment and/or any equipment aiding in the performance of the tests;
G. The level and schedule of preventive maintenance to be permitted during the test;
H. Pass/Fail criteria;
I. Procedure for Test Failure Resolution;
J. Test data sheet format;
K. A breakdown of the day-to-day schedule for performing the test;
L. A layout of the testing facilities to be used;
M. Test Reports;
N. Summary of testing activities;

The test procedures shall be provided to WMATA 45 days prior to the scheduled date for each test, including each of the First Article Test to ensure that WMATA will be able to review and approve the test procedures 15 days in advance of the test. Where required by WMATA, the Contractor shall update test procedures and resubmit them to WMATA.

4.1.5 Test Results Reports

Test reports shall be prepared in accordance with the test procedure and signed by all responsible witnessing parties. The test reports shall be submitted to WMATA for approval of test completion within one week of completion of associated testing. WMATA shall either accept or reject the test report, with reasons, within 21 days after receipt of test results.

If WMATA decides not to witness, or to not have a representative witness a test or tests, test reports shall nevertheless be submitted to WMATA for approval.

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4.2 Component and System Level Testing

The Contractor shall subject all components of the faregates and the fully integrated system to a rigorous testing regimen. The Contractor shall plan for, perform, monitor, and document all tests required to prove the design and acceptability of the faregates and the current system payment application interface, including all elements, subsystems, and the system as a whole, as well as the level of functionality required for deployment. The Contractor shall furnish equipment that meets the criteria specified for all tests. Testing shall not commence until all designs affecting the faregates and all supporting system and all related testing procedures have been approved by WMATA.

Testing shall be conducted to coincide with the major implementation phases of the project. Work on any succeeding phase of the project without satisfactory completion of testing in a prior phase shall be at the Contractor's risk.

Central system testing shall validate the system's performance under an expected stress-case daily operational scenario. This test shall be designed to incorporate and test the centralized capabilities and all, interfaces with current fare payment application. The system capacity stress test shall be performed at the beginning of the Reliability, Maintainability and Accuracy Test (RMAT).

4.3 Testing Phases

The functionality of faregates and supporting systems shall be tested to:

- Verify that the hardware meets all environmental requirements (initially and when modifications are made to accommodate additional functionality);
- Verify that the system performs as defined by WMATA; and
- Ensure that there is no performance degradation when additional functions are implemented (rigorous regression testing shall be provided).

When new functionality is introduced, at least 10% of the previous functions tested shall be retested to ensure that the modifications to the system had no impact to system operation, function or performance. WMATA shall approve all regression testing items.

4.4 Communication Testing

Faregates shall interface with current fare payment application, and provide centralized controls and reporting capability. Portable Station Manager Devices shall interface with WMATA's LAN and Wi-Fi communications. All communications interfaces and system hardware shall be fully installed and tested prior to deployment. This testing shall be performed for all portions of the communications network.

Testing shall verify that the interface with the current fare applications, network and communication systems can fully support and operate as specified.

The Contractor's plan for this test shall be provided for WMATA approval. This test plan shall identify all aspects of the testing to be performed as well as the test equipment and procedures to be used.

Communication tests shall be performed to demonstrate all the network systems and all related sub-systems have been properly configured and optimized; and that they will operate fully and properly without a major system failure. Communication Test Procedure **CDRL 4-3** is due 90 days before planned test.

All instances of performance, which do not meet the specified requirements, shall be identified by the Contractor, and included in the test report. The test report shall also include a plan for resolution of these issues. The test report shall be provided not more than twenty-one (21) days after completion of the network testing. **CDRL 4-4.**

Corrections required as a result of the testing and verification shall be performed by the Contractor prior to delivery of any additional faregates.

4.5 First Article Test (FAT)

The purpose of this test shall be to demonstrate that the system furnished and installed provides all functions, features and requirements as specified. The primary tool that shall be used during this test shall be the Nextfare 5 simulator, which shall mimic the actions and behaviors of a full NextFare 5 back end system. The simulator shall connect to the faregate systems to verify and confirm the proper operation and response of faregates in a testing environment. It shall be provided to the contractor prior to FAT. The FAT shall be performed at the Contractor's facility in the United States. Successful completion of this test shall serve as the prerequisite for beginning production of system equipment. The FAT shall be considered successfully completed when all functionality has been verified, without exception.

At this level of testing, the equipment tested shall be equal to the final production devices. The individual tests comprising the FAT shall include:

A. Functional Test
B. Environmental Tests

    1. Vibration Test
    2. Shock Test
    3. Electromagnetic Effects Test
    4. Radiation and Electromagnetic Interference Test
    5. Temperature/Humidity/Voltage
    6. Water Intrusion
    7. Dust Test

C. First Article Enclosure Integrity Test
D. Maintainability Test
E. Central System Software Verification Test
F. System Interface Test
G. Application Verification Test
H. Cycling Test
I. Report Generation Test

Included for the FAT with all equipment being tested shall be the Simulator Lab. As a part of the First Article Testing, the operation of the Simulator Lab shall be verified to ensure that it can perform its proper function. This shall include all functions required to

verify software changes to the equipment, tariff changes, configuration changes and other functions as identified throughout these Technical Specifications. FAT Test Procedures **CDRL 4-5** are due 90 days prior to the start planned tests and test results **CDRL 4-6** are due 21 days after tests are completed.

4.5.1 Functional Test

The Contractor shall provide functional test procedures that satisfactorily demonstrate all equipment functions according to these specifications and that all performance requirements will be met.

The purpose of this test shall be to demonstrate correct operation for each type of equipment including all of the functions specified throughout this document, and all limiting conditions. A Faregate, ADA Faregate and Station Manager Device shall be required to successfully execute all hardware and software functions as defined and identified in the specifications, and any further definitions or clarifications made during the ensuing design process.

All performance level criteria requirements shall be tested and verified during these tests. The procedures for handling maintenance (trouble shooting, and correcting faults) and service functions (extracting data) shall also be successfully demonstrated, ensuring adherence to contractual requirements and shall be included in the test procedures identified above.

Each unit of equipment shall have passed the functional test before the environmental tests listed below are started.

4.5.2 Environmental Tests

The testing to be performed shall be as identified in the following subsections. The Contractor may suggest alternative testing protocols, standards and procedures for any or all of the defined environmental tests, but no waiver, exclusion, or modification shall be deemed granted by the Contractor in the design of the system or any of its components. Should a waiver not be granted or substitution not be permitted, the system shall meet all of the environmental requirements defined herein without change or modification to these technical requirements or associated other requirements.

All equipment software for the environmental test shall be identical to that which was exercised during previous tests.

4.5.2.1 Vibration Test

The Contractor shall ensure that all equipment and mounting hardware/fixtures proposed are both resilient and protected from vibration conditions expected in their intended environments.

The purpose for this test is to ensure that all equipment and mounting hardware/fixtures can withstand the vibrations common to the installation environment, including proximity to both slow and fast moving passenger and freight trains. The testing for these various

types of equipment shall include verification that the equipment operates properly at the completion of each of the testing cycles without modification or adjustment.

4.5.2.2 Shock Test

The purpose for this test is to ensure that the equipment can withstand the intermittent shocks common to the installation environment including proximity to both slow and fast moving passenger and freight trains, passenger abuse on the platform and attempts at intrusion and vandalism. Requirements for shock testing shall conform to the following:

The Contractor shall ensure that all equipment proposed shall be tested per MIL-STD 810F, Method 516.5, Section 4.5.2.3, Procedure 1, with the following changes:

- The half sine shock pulse shall have a peak value (A) of 5g and a duration (D) of 20 milliseconds.

The equipment shall operate normally after the shock tests and shall not have experienced broken or loosened components as a consequence of these tests.

4.5.2.3 Electromagnetic Effects Test

The Contractor shall ensure that all equipment proposed shall be tested for electromagnetic interference as applicable per the following:

A. Susceptibility to Radiated Electromagnetic Energy - The equipment shall be tested for susceptibility to radiated electromagnetic energy per the requirements of MIL-STD-461E for radiated emissions, electric field. The equipment shall not sustain any permanent damage as a result of the exposure to these electromagnetic fields nor shall it lose its data in RAM and non-volatile data storage. Loss of data relative to a transaction during the exposure is undesirable.

B. Susceptibility to Conducted Electromagnetic Energy - The equipment shall be tested for susceptibility to conducted electromagnetic energy per the procedures of MIL-STD-461E, Requirement CS116, utilizing the 400 volt, 5 microsecond pulse of both positive and negative polarity. The equipment shall not sustain any permanent damage as a result of application of the pulse energy nor shall it lose its data in RAM storage.

C. Radiation of Electromagnetic Interference – All equipment shall comply with applicable Federal Communication Commission regulations (i.e., FCC Rules, Part 15, Subpart J) concerning conducted and radiated radio frequency energy and shall provide certification or test results verifying compliance.

D. The following criteria shall also be considered for verification of testing as identified within this Section. The Contractor shall identify to which of these requirements their equipment shall conform and WMATA shall approve the voltages, timings and other pertinent testing criteria:

1. IEC 1000-4-6 (= EN 61000-4-6) pertaining to conducted susceptibility;
2. IEC 61000-4-3 (= EN 61000-4-3) pertaining to radiated susceptibility;
3. IEC 61000-4-2 (= EN 61000-4-2) pertaining to electrostatic discharge;

E. The following criteria shall also be considered for verification of testing as identified within this Section:
1. FCC Part 15, Subpart B Class A (Conducted emissions), pertaining to conducted susceptibility;
2. FCC Part 15, Subpart B Class A (Radiated emissions), pertaining to radiated susceptibility;
3. SAE J-1113-13 pertaining to electrostatic discharge.

4.5.2.4 Temperature/Humidity/Voltage Test

The temperature and humidity requirements for these tests are as identified in Table 4-1. Once the specified temperature and humidity levels have been reached in the test chamber for a particular test, the equipment undergoing testing shall be placed in the chamber and allowed to stabilize for a minimum of two hours prior to test commencement. The number of test cycles to be performed during each test and for each type of equipment shall be identified by the Contractor in the test plan and procedures, and subject to approval by WMATA prior to test commencement.
Faregates shall be subjected to the following environmental test for Temperature/Humidity/Voltage. The equipment shall be allowed to stabilize for a period of two hours at each given environmental condition setting. Thereafter, the number of transactions to be processed shall be as indicated in Table 4-1 and the equipment cycled as per procedures established for Cycling Tests.

Table 4-1 – Environmental Test Conditions

Run No.	Exterior Temperature	Exterior RH (%)	Solar Loading	Input Voltage	# Transactions
1	Minimum per Section 2	20-40		nominal +5%	250
2	Maximum per Section 2	50	Maximum per Section 2	nominal power	250
3	80° F	95		Maximum per Section 2	250
4	80° F	95		Minimum per Section 2	250

Run No.	Exterior Temperature	Exterior RH (%)	Solar Loading	Input Voltage	# Transactions
5	32° F	80		Nominal -5%	250

Successful completion of this phase of the Environmental Test requires no more than one relevant failure.

4.5.2.5 Water Intrusion Test

Faregates shall be subjected to and successfully pass UL 50 3R Water Ingress testing. In addition, a water ingress test shall be conducted, in which worst-case rain and wind conditions as specified in Section 2, shall be simulated.

4.5.2.6 Dust Test

Faregates, shall be subjected to and successfully pass a test that will verify whether suitable enclosures and filtering are provided to protect the equipment and its sensitive components from malfunction resulting from dust particles. Type 1 general-purpose Portland cement is to be used for the test media as it has a controlled maximum particle size (.0381mm to .0737mm). The air velocity at the outlet of the blower shall be at least 1000 feet (305 m) per minute, with the blower cycled for 15 seconds on and 30 seconds off, for the duration of the test. Where possible, positive air pressure and appropriate filtering shall be used to reduce the dust intake. This dust test shall include varying lengths of exposure as identified Table 4.2.

Table 4-2 – Dust Exposure Test

Duration of Test	Fixed Location Equipment
One Minute	X
Fifteen Minutes	X
Thirty Minutes	X
Sixty Minutes	X

4.5.3 First Article Enclosure Integrity Test

Upon successful completion of the First Article Configuration Inspection (FACI), the First Article faregates shall be installed to a concrete floor in a manner identical to the proposed and WMATA-approved installation method. Each enclosure shall then be subjected to the maximum forces as defined in Section 2 in the following manner:

A. In preparation for the test, each faregate shall be leveled and fully secured.

B. Each faregate shall have the maximum horizontal force applied at the top of the enclosure, perpendicular to each of the enclosure's four sides. The force shall be applied for 30 seconds in each direction. For each force application, when the force is removed, the cabinet shall be inspected for deformations and inclination from perpendicular. Any deformations or deviation from perpendicular shall constitute test failure.

C. The faregate shall have its door opened to between 90 and 120 degrees and the maximum weight applied to the edge of the door for 30 seconds. After the weight is removed, the enclosure shall be inspected for deformation and inclination from perpendicular. Any deformations or deviation from perpendicular shall constitute test failure.

4.5.4 Maintainability Test

The Contractor shall conduct a Maintainability Test of faregates. The purpose of this test is to determine that the equipment tested conforms to the maintainability requirements specified. Specific faults shall be introduced as test cases and the time required for a trained technician to correct the fault, successfully returning the equipment to revenue service, shall be recorded. WMATA shall select the failures at the commencement of the Maintainability Test.

The Contractor shall prepare a test outline for the Maintainability Test plan that shall identify the sample size[1] and a list of all faults to be introduced into the equipment. This list shall represent every known failure mode for each unit of equipment, and all functionality.
The test shall be conducted in the following steps:

A. The Contractor shall provide no fewer than three faregates to introduce failed components, miss-adjustments and incorrect settings. The simulated failures shall be introduced in proportion to their expected failure rate.

B. The Contractor's maintenance personnel shall be unaware of the simulated failures and shall be assigned to repair the equipment.

C. The repair times shall be recorded and MTTR shall be compared, individually and collectively, with the advance list provided by the Contractor. All results shall be approved by WMATA. Repair times shall be measured from the time the maintenance personnel arrive at the equipment to the time the equipment is placed back into revenue service.

[1]. The sample size shall be statistically valid and provides a high degree of confidence.

4.5.5 Faregate Software Verification Test

The Contractor shall conduct a Software Verification test. The purpose of this test is to prove that each of the functions provided by each of the application servers operate as specified.

For this test, at least one of each type of faregate cabinet and all supporting field equip is required so the functionality can be proven. The functions covered shall include all functions provided by the faregate and all fare payment media and fare products. For example:

- All functions centrally controlled applications;
- System setup, including security accesses, including network address allocation;
- System monitoring;
- Alarm generation and reporting;
- Base fare transactions;
- Pass product fare transactions;
- Autoload fare transactions;
- Low balance fare transaction;
- In-valid media transactions;
- Fare revision;
- Query and report generation and execution;
- Automatic generation of daily summary tables;
- Data archiving and recovery;
- Emergency conditions;
- Station workstation overrides;
- Local faregate configuration management;
- Remote faregate configuration management
- Local faregate log-in and log-out
- Remote faregate log-in and log-out.

All instances of performance, which do not meet the specified requirements, shall be identified by the Contractor and included in the test report. Corrections required as a result of the testing shall be approved by WMATA and performed by the Contractor prior to delivery of any additional equipment.

4.5.6 Faregate Current Fare Payment Application System Interface Test

The Contractor shall design and conduct the System Interface test to evaluate how well and accurately the equipment and software provided interfaces with the current fare payment application. The individual tests within this Section shall be performed under varying conditions, using a statistically valid sample that will demonstrate all functions as specified for all fare payment applications and accepted WMATA fare media and fare products. The interfaces to be tested shall include all interfaces between the faregates, PPTs and the current fare payment system in WMATA's AFC simulation laboratory.

As a part of the System Interface test, verification of the proper interoperation with those external interfaces shall also be proven. These interfaces shall include but not be limited to:

- Entry and exit fare transactions;
- Pass product and special user class fare transactions;
- Autoload transactions;
- Fare table updates;
- Invalid media attempted transactions;
- Customer interfaces;
- Software updates; and
- Data polling.

The software tested shall be complete and ready for delivery to WMATA. All potential functions and operational situations shall be included in the test in order to demonstrate that the interfaces meet all of the system requirements.

During this testing the Systems Integrator shall be responsible for correcting any issues related to the behavior and operation of the PPT, including (but not limited to):

- PPT authentication to the Nextfare 5 backend
- Media validation
- Current Fare-table downloading and execution
- Hotlist downloading and execution
- Download and issuance of Autoloads Transactions upload to Nextfare 5
- Detection and processing of concession fare media
- Detection and logging of invalid media
- Time synchronization with designated time server
- Download and execution any other required operational tables

During this testing, the faregate contractor shall be responsible for correcting any issues related to the operation of the faregate hardware and software, and the faregate control system including, but not limited to:

- The execution of locally and remotely initiated faregate diagnostics
- The execution of locally and remotely faregate configuration commands
- The forwarding of device alarms and alerts to the faregate control system
- Correct responses to the result of media processing (open barriers or prohibit opening) as determined by PPT
- Correct operation with station emergency system
- Incrementing of correct audit registers based on transaction types
- Authentication to faregate control system.
- Time synchronization with designated time server
- Presentation of proper displays and indicators based on current processing or faregate status

During this testing the contractor and the systems integrator shall jointly share responsibility for correcting any issues related to or arising from communications across the faregate to PPT interface.

All instances of performance, which do not meet the specified requirements shall be identified by the Contractor and included in the test report. Corrections required as a result of the testing shall be approved by WMATA and performed by the Contractor prior to delivery of any additional equipment.

4.5.7 Cycling Test

The cycling test shall be conducted. The cycling tests shall be conducted at a minimum, as shown in Table 4.3. WMATA, at its sole discretion, may opt to provide an enhanced Cycle Test Requirements list during the design Review Phase. Additional Cycle Tests may be necessary as a result of design review meetings and proof of design.

A mix of fare types shall be used for the cycle test including, but not limited to, fare media configured as Adult, Child, Senior, Disabled and Employee categories.
Table Key for Media Type:

- SM – WMATA issued smart media and Partner issued smart media;

In addition, the cycle test shall also include not less than 10% additional transactions with invalid media. Cycling Test Plan **CDRL 4-4** is due 90 days before planned testing.

Table 4-3 – Minimum Cycle Test Requirements

Trial #	Media Type	Transaction Description	Qty.	Tests
Faregate / ADA Faregate				
66	SM	Pass Usage	100	2
67	SM	Pass Usage	100	2
68	Present	Pass Usage	100	2
69	SM	SVC payment	50	2
72	SM	Accept Round Trip Media (outbound)	25	2
73	SM	Reject insufficient stored value	25	2
75	SM	Reject depleted/expired/used OW/RT Media	25	2

4.5.8 Report Generation Test

The system shall be provided with test data simulating WMATA database for purposes of this test. Throughout this test, the date and time shall be modified a minimum of ten times incorporating dates from a minimum of five different years.

These functions shall include, but not be limited to, the following:

A. Alarm transmission and all other device/component monitoring functions (for all devices);
B. Data transmission to and from the central system);
C. Data transmission from the central system (for all faregates and station workstations ;
D. Fare Table modification, download and verification simultaneously to all devices;
E. Configuration modifications from all faregates; and
F. Automatic report generation.#

The Contractor shall identify each integrated function in its Test Procedures, including the boundary conditions and security provisions.

All data transmissions shall be inspected and tested for accuracy. Inaccurate data transmissions shall be recorded as a failure. The Contractor shall take any corrective action necessary to ensure the proper performance of all functions.

Samples of all reports available shall be generated. Format, layout, page and column headers, data, and all other information shall be reviewed to confirm compliance with the designs approved at the Final Design Review subject to any subsequent agreements. Successful completion of the test requires no discrepancies between report contents and known data as well as proper formats.

4.6 Production Acceptance Test (PAT)

This test will be performed by the Contractor at its North American facility to verify faregates are consistently manufactured, and fully complies with final functional requirements and hardware configuration. This test will occur for all equipment that will be part of both the Initial Revenue Service Test (IRST) and RMAT testing. Successful completion of the PAT is a prerequisite for delivery of equipment to WMATA's sites for additional testing.

Once this test is successfully completed, the equipment shall be available for shipment. The Contractor shall provide to WMATA certification in writing, in addition to providing the actual test results for review, when the FAT Functional Test has been passed. WMATA will identify, when necessary, required modifications to be made and demonstrated before approving release for shipment. WMATA shall have, at their discretion, the right to provide on-site oversight of the PAT. PAT Test Procedure **CDRL 4-7** is due 90 days before scheduled testing and test results **CDRL 4-8** are due 21 days after the completion of testing.

4.7 Pre-Installation Checkout (PIC)

Prior to commencement of the IRST, a Pre-Installation Checkout (PIC) shall be conducted at the storage warehouse. WMATA will select five faregates from each delivery. The test objectives are:

A. To confirm that there was no visible damage in the delivered equipment;
B. To visually inspect a random sample of mobile equipment for conformance with specifications;
C. To determine by these procedures if installation can begin or corrections and/or adjustments are needed followed by a retest before installation can begin.

PIC Checklist and Procedure **CDRL 4-9** is due 90 days before scheduled delivery of faregates.

4.8 Pilot and Installation Checklist

This test will be performed by the Contractor at and observed by WMATA or its appointed representative to verify that the equipment, which successfully completed PAT testing, continues to perform as expected after it has been installed and to verify that all safety certifiable and ADA certifiable items are in compliance prior to revenue service. This test will occur for all equipment. The Installation Checklist is in addition to Installation Acceptance Tests, which are part of the Installation Plan.

A three faregate pilot deployment at 10 different mezzanines will be done prior to faregate installation to verify that faregates and central system applications preform according to requirements. One of the 10 pilot faregates shall be an ADA faregate.

Pilot faregates will remain in service for not less than 21 days and until all faregate functionality, transaction processing, and faregate local and central management and reporting functionality has been verified. The Pilot will be considered complete when all system functionality is verified and faregates are operational without failure for 10 days.

Successful completion of the Pilot is a prerequisite to placing devices into revenue service and starting the Initial Revenue Service Test. Pilot and Installation Checklist **CDRL 4-10** are due 90 days before the planned installation of pilot devices. Pilot performance and events will be reported weekly and the final Pilot Test Report **CDRL 4-11** is due 21 days after the completion of testing.

4.9 Initial Revenue Service Test

This test shall be performed after successful completion of the IAT on a predetermined set of installed faregates. The test shall be conducted with a population of devices equal to no less than 10% of the quantity of faregates or 15 station mezzanine installations.

The IRST shall be conducted for a period of not less than five consecutive weeks. The testing is designed to verify the system is operating in a reliable and accurate manner when subjected to actual in-service revenue conditions. The IRST period shall be completed when faregates and all supporting systems and applications run without incident for 14 days and all corrective actions impacting revenue service are closed. WMATA reserves the right to stop faregate deployment if there are significant system failures are events that impact WMATA's ability to collect fare payments or operate faregates.

The first seven days of the IRST shall be designated as a settling period, but with all normal operations for revenue service carried out and accuracy and reliability data documented. Prior to this period, a Failure Review Board (FRB) shall be set up. The FRB shall review the reported failures, categorizing them for inclusion into the IRST statistics. For each reported failure, the Contractor shall provide a plan as to the corrective actions necessary to repair the defect. The FRB shall review all failures and provide an analysis for the cause of the malfunction. At the end of the settling period, the IRST shall begin and shall be conducted over the next 28 days. The Contractor shall be responsible for performing all maintenance actions during IRST. IRST Test Procedure **CDRL 4-12** is due ninety days before planned start of faregate deployment and IRST Test Report **CDRL 4-13** is due 21 days after the test is completed.

4.10 Required CDRLs

CDRL No.	Description	Section	Due	Approval Required
CDRL 4-1	Test Program Plan	4.1.3	PDR, FDR	Yes
CDRL 4-2	Test Waiver Request	4.1.2	PDR	Yes
CDRL 4-3	Communication Test Procedure	4.3	90 days before planned tests	Yes
CDRL 4-4	Communication Test Results	4.3	21 days after test completion	Yes
CDRL 4-5	FAT Test Procedures	4.5	90 days before planned tests	Yes
CDRL 4-6	FAT Test Report	4.5	21 days after test completion	Yes

CDRL No.	Description	Section	Due	Approval Required
CDRL 4-7	PAT Test Procedures	4.6	90 days before planned tests	Yes
CDRL 4-8	PAT Test Report	4.6	21 days after test completion	Yes
CDRL 4-9	PIC Procedure and Checklist	4.7	90 days prior to the delivery of faregates	Yes
CDRL 4-10	Pilot Test Procedures and Installation Checklist	4.8	90 days before planned tests	Yes
CDRL 4-11	Pilot Test Report	4.8	21 days after test completion	Yes
CDRL 4-9	IRST Test Procedure	4.9	90 days prior to deployment	Yes
CDRL 4-10	IRST Test Report	4.9	21 days after the IRST period	Yes

5 Deployment

This section covers the deployment planning and installation requirements of faregates and supporting equipment. The Contractor shall ensure that all Federal, State, District and municipal requirements, insurance, regulations and standards are met during the implementation, including obtaining right-of-way access in accordance with WMATA Construction and Safety requirements. All such elements shall be incorporated into the deployment planning deliverables. During deployment, the Systems Integrator shall be responsible for implementing all configuration changes in the Nextfare 5 central system, that are required to support all newly deployed field devices. WMATA shall be responsible for making the necessary configuration changes in the Station Operators Console (SOC) to support the adjustments made to the equipment in stations, including device de-commissioning, during the deployment of new faregates. WMATA shall also be responsible for furnishing the schedule of IP address that are to be used for all newly deployed devices.

5.1 Deployment Plan

WMATA requires that faregates be deployed so that revenue service is not disrupted and that current faregates are removed only as new faregates are deployed. WMATA requires that no more than one faregate aisle be left out of service at any mezzanine while new faregates are installed unless otherwise approved. In instances, in which WMATA's emergency egress levels are impacted, deployment plans must include contingencies for Fire Watch Protection or strategies to complete faregate installation without leaving an aisle out of service.. The Contractor shall be required to develop a Deployment Plan that details the deployment approach and compliance with all WMATA safety and security requirements. The Deployment Plan shall be developed 180 days prior to the planned deployment start. **CDRL 5.1**

The Contractor shall be responsible for the delivery, storage and safekeeping of all faregates until faregates are fully installed and accepted.

5.2 General Installation Requirements

All equipment removal and installation work shall be performed in accordance with WMATA standard requirements and standard operating procedures listed below:

- Construction Safety and Environmental Handbook;
- MetroRail Safety Rules and Procedures Handbook;
- Safety and Security Certification Program Plan;
- WMATA Contractor Safety Vest Specifications; and
- System Safety Program Plan.

Where the requirements below are in conflict with or are less restrictive than the WMATA standard requirements, the WMATA standard requirements shall take precedence.

5.2.1 Safety Certification Project Plan

The Contractor shall submit a Safety Certification Project Plan in accordance to WMATA's Safety and Security Certification Program Plan detailing faregates safety item and

faregate installation safety certifiable elements. **CDRL 5-2**. The Contractor shall obtain written approval from the Authority's Safety Department that the Contractor demonstrates compliance with WMATA's and Safety and Security Certification Program Plan before any work can commence.

5.2.1.1 Installation and Interface Plan

The Contractor shall submit to WMATA for review and approval an Installation and Interface Plan (IIP). The IIP shall indicate the method of installation and connections, the installation schedule for each station mezzanine, as well as installation testing and any support requested of WMATA to properly install the equipment. The IIP shall include provisions for the installation of test faregates in WMATA's AFC Lab and Maintenance Training Facilities.

The IIP shall provide information on the personnel assigned to the installation, their duties, and the on-site project manager for the Contractor for this phase of the project. The IIP shall include installation instructions and drawings for each type of faregate equipment that is to be installed. The Contractor shall be responsible for the removal of current faregates and for delivery, installation and testing of all new faregate cabinets.

The IIP shall include a description of the step by step procedures to be followed for the installation, finishing, and communication interface with back end systems.

The Contractor shall submit the IIP for WMATA review at the Preliminary Design Review. The Final IIP shall be submitted for WMATA's review and approval at the Final Design Review. **CDRL 5.3.**

5.2.1.2 Contractor/WMATA Work Site Responsibility Limits

Metrorail station/mezzanine site work responsibility limits between the Contractor and WMATA are as follows:

A. WMATA shall furnish, install, terminate and test one CAT6 Ethernet cables from the mezzanine Ethernet switch to the current faregate to support new faregate communication interface. At the equipment/component-end, Contractor shall tag and connect the CAT6 (RJ45).
B. WMATA shall furnish and install the mezzanine Ethernet switch and terminate the CAT6 cables to the switch. .
C. WMATA shall furnish, install, terminate and test the fiber optic cable from the mezzanine Ethernet switch to the Communications Equipment Room (CER).
D. WMATA shall provide the CER Ethernet connection to the MetroNet network.

E. As required, WMATA shall furnish and install new power cables from the electrical panel board to the kiosk to be used if new power circuits are required to support new faregates (it is anticipated that new faregates will use power circuits and receptacles that support current faregates).
   1. Spare cables shall be cut to ample length, and be provided without any type of end connector. Contractor shall tag and terminate power cables to their equipment if needed.

F. WMATA shall handle and manage all power circuits at the mezzanine/station's electrical panel board(s).

G. WMATA shall maintain operation of all existing AFC System equipment and connection cabling at the station.

H. WMATA shall perform all floor tiling repair work, however if tiles are damaged at the time of installation, the Contractor is responsible for ensuring that the site is free of tripping or other safety hazards while tile repair work is coordinated.

I. Contractor shall be responsible for any damage incurred to the cables or the cable infrastructure.

J. Contractor shall be responsible for replacing and/or repositioning electrical receptacles inside the faregate cabinets where existing receptacles interfere with faregate installation and for replacing receptacles in in instances where the replacement of the power receptacles does not resolve the power issue, it will be WMATA's responsibility to further troubleshoot the issue.

5.2.1.3 Site Access and On-Site Work

Faregate installation work will be completed during non-revenue hours Monday through Friday (Monday 3rd shift starts at 10:00 pm Sunday evening). Contractors will have access to rail stations from 10:00 pm to 5:00 am, but installation tasks that impact customers cannot begin until the station closes unless otherwise approved by WMATA. Stations closing times vary and according to the time the last service train reaches the station and the last customer exit the station.

The Contractor shall plan and execute safe access to the work site for on-site work. Such safe access shall be afforded to construction equipment, vehicles, and personnel in accordance with WMATA requirements.

Access dates will be subject to revision as delivery, testing and installation of faregates progresses. Therefore, the Contractor shall incorporate flexibility into the installation schedule.

5.2.2 Site Specific Work Plan and Supplemental Site Work Plans

The Contractor shall develop a Site Specific Work Plan (SSWP) that details work requirements that need for faregate deployment at each station mezzanine. The SSWP shall provide WMATA with a detailed description and breakdown of all construction and installation requirements necessary for any given location, including a detailed narrative

that expands upon the Contractor's approach as defined in their Technical Proposal, as finally accepted.

The SSWP shall provide detailed demolition and construction drawings to sufficiently outline equipment removal and installation of equipment, conduit, cabling, and any other materials are part of this project. In addition, the SSWP shall address all phasing of efforts at any given location, including with sub-contractors as well as with other efforts undertaken by WMATA. The SSWP must be approved by WMATA's Safety Department before any faregate deployment or demolition work can begin.

The SSWP shall include details for trash and waste removal and contingency plans for how repairs will be made to WMATA facilities and stations in the event that damage results from equipment removal, construction, or installation. This information includes the types of products (material, manufacturer, grade, color) and methods that are to be used to match the surrounding existing conditions.

The SSWP shall provide a description of work and a breakdown of labor force that outlines labor, equipment, and responsibilities of each party, including WMATA support labor. As part of this, the Contractor shall provide a time scaled hourly logic network that provides an hour-by-hour breakdown of the Contractor's and others related activity.
The SSWP shall include plans for equipment and tool delivery and storage. Plans shall include barriers and/or other protections to secure equipment and minimize impact on customer ingress and egress during revenue service hours.

The SSWP shall include verification of NFPA 130 equipment compliance. This includes verification that faregates automatically open in conditions where there is a lack of power, ground fault, emergency alarm, and activation by manual switch. The SSWP shall also include plans and procedures for Fire Watch Protection if needed.

Supplement work plans will be developed for sites that require additional planning and coordination or special tasks for the delivery and installation of equipment specific for that location. This includes requirements for work done on the platform level may require track foul time access rights and confined space certified worker) or locations that do not have elevator access to the mezzanine level and require special support for the delivery of equipment. Depending on site attributes, supplemental work plans may require details for:

- Requirements for a Contractor's watchperson;
- Required WMATA flagging and support;
- Requirements for specialized escalator supports to move equipment;
- Requirements for specialized lifts are riggers (if equipment weight and size exceeds limits of escalator lifts);
- WMATA main and support department(s) escort(s) identified
- All related construction methods;
- Arrangements for emergency clearing and restoration of service;
- Sketches for defining the configuration other operational elements at completion of work.

In addition, the Contractor may need to foul a section of track or require a complete service outage for work done on the platform level. The Supplemental work plan shall address all requirements for outage, including time and duration. While the SSWP shall address any potential fouling or outages that will occur, it does not supersede or replace the need for an Outage or Fouling Request.
The Contractor shall submit an outline of the SSWP for WMATA review at the Preliminary Design Review. The system wide SSWP shall be submitted no less than 120 days prior to the commencement of work. **CDRL 5.4**

Supplemental work plans shall be submitted no less than 90 days before the commencement of work at those locations. No work shall begin at a location until the related SSWP and Supplemental Work Plans have been submitted by the Contractor and approved by WMATA. The SSWP and/or Supplemental Work Plans shall be updated as necessary and resubmitted to WMATA for subsequent review and approval. **CDRL 5.5**

Not later than 60 calendar days before the planned work begins, the final approved SSWP and where applicable Supplement Work Plans shall be distributed to all parties and be available on-site during faregate installation.

The SSWP and Supplemental Work Plans will be approved by all departs that are impacted by or that have responsibility for interfacing systems related to planned work. WMATA"s Safety and Environmental Management Department has the final approval for these submittals. The approved SSWP and Supplemental Work Plans must be distributed to all parties and available on site at all times.

The Contractor shall not perform any of the work required until written approval has been received from WMATA. WMATA will not grant track outages, powers outages, or track occupancy until the Contractor's SSWP has been reviewed by the Authority Representative and approved in writing. The Contractor is advised that WMATA reserves the right to cancel or re-schedule an approved outage in the event of an operating emergency (derailment, system failure, power failure, etc.) in which support/protection personnel may not be available.

As applicable, the Contractor and/or subcontractors requiring entry into the rail revenue operating system, including rail maintenance yards, for performance of Contract work shall provide such employees requiring entry with photo identification cards issued by the Authority. The Contractor shall obtain and be responsible background checks and badge request documentation in accordance with WMATA policies.

ROW Safety Training, administered by the Authority, will be required for Contractor and Sub Contractor employees that require access to the Metrorail system prior to working on the system. The Contractor's Safety Superintendent shall schedule the ROW Safety Training through the WMATA's Safety Department.

The Contractor and Sub Contractors shall not begin work on any day until authorized to do so by the Authority's Safety Representative or an appointed designee.

The Contractor shall coordinate and schedule all work with the Authority to ensure that the Contractor's activities do not interfere with the operation of or access to the Authority's facilities.

5.2.3 Contractor Employee Safety Management Program

The Contractor and/ or Sub-Contractor responsible for the installation of faregates shall provide documentation of company's safety program and adherence to: OSHA Regulations and Standards applicable to the scope of work defined within this Section and these Technical Specifications;

- WMATA specific Work Site Safety Requirements; and
- All other governmental agencies having jurisdiction over the work.

The Contractor shall be required to assure that all employees, subcontractors, and suppliers/vendors, while on any WMATA work site and/or in the conduct of the Contract, comply with the provisions of these safety regulations and standards.

The Contractor's ESMP, which, at a minimum, shall include but not be limited to provisions for the following:

A. Construction Orientation;
B. OSHA Inspection and Compliance;
C. General and Site Specific Safety;
D. Workmen's Compensation Reporting;
E. Fall Protection/Personal Protective Equipment;
F. Confined Space;
G. Hazardous Materials;
H. Trenching and Excavation;
I. Electrical Protection;
J. Drug and Alcohol;
K. Public and Passenger Protection; and
L. Blood pathogens.

The Contractor shall identify a qualified safety officer who shall be responsible for all safety-related activities until the completion of the work at each WMATA work site. The safety officer shall report all on-the-job injuries at once to WMATA and submit all documentation pertaining to such injuries, as required.

The Contractor's ESMP shall provide a detailed description and breakdown of practices and procedures for the following Regulatory and Safety requirements:

A. General Safety Requirements;
B. Emergency Procedures;
C. Protection of WMATA Facilities;
D. Storage and Handling of Materials;
E. Environmental Protection, including but limited to:
F. Protection of Natural Resources;
G. Erosion and Sediment Controls;
H. Toxic Substances;
I. Control and Disposal of Chemical and Sanitary Wastes;
J. Dust Control;
K. Protection of Existing Water and Sewer Lines.

The Contractor's ESMP shall also provide a detailed description and breakdown of practices and procedures for the following additional requirements:

A. Responsibility for Work Site Operations;
B. Contractor Personnel including Contractor's Protection Assurance Representative;
C. Right of Way Restrictions;
D. Electrical/Third Rail/Overhead Wires Safety;
E. Emergency Guidelines.

The Contractor shall submit an outline of all ESMP for WMATA review at the Preliminary Design Review. Final ESMP shall be submitted for WMATA's review and approval at the Final Design Review and not less than 120 days prior to the start of planned installation tasks. **CDRL 5-6**

5.2.4 Existing Equipment Removal

The Contractor shall supply all of the labor, supervision, and materials required for the proper and complete removal of the existing faregates that the equipment to be furnished under this contract will replace. Such removal shall be accomplished without damage to the removed equipment, or facility from which it was removed, or any equipment remaining on the vehicle or at the facility.
The Contractor shall leave the site from which equipment was removed in a safe condition, and remove or correct all hazards to the Customer, which shall include at a minimum flush filling of any holes and removal of any exposed conduit stub-ups and wiring.

WMATA does not anticipate major or significant demolition activities to be necessary in the removal of existing equipment. However, the Contractor shall repair any damage or unsightly conditions that result from equipment being removed. As part of this, any repair or replacement work shall match existing finishes and conditions. This shall be accomplished through the use of commonly utilized products and procedures and shall be subject to WMATA's review and approval.

The Contractor shall describe demolition task in the SSWP and in the Deployment Plan. The Contractor shall document the equipment serial number, WMATA asset number, and date of removal for all current equipment removed from the site and document serial number for faregates and key components of installed devices. **CDRL 5-7** The Contractor will be responsible for storage equipment unit WMATA has completed its asset retirement process or up to 90 days after all equipment has been removed. .

5.2.4.1 Removed Equipment Storage

The Contractor shall place the removed WMATA faregates at a Contractor-provided local storage location (within the limits of WMATA service area) for review by WMATA.

After the implementation for the phase has been accepted, WMATA shall be provided the opportunity to review the removed equipment, identify equipment, modules and other components it wishes to retain and remove those components from the storage location.

The Contractor will be responsible for storage equipment until WMATA has completed its asset retirement process or up to 90 days after all equipment has been stored. WMATA will be responsible for the final disposal of removed equipment.

After WMATA has completed this review and removal, all remaining materials at the storage location shall become the property of the Contractor.

5.2.5 Faregate Installation

The Contractor shall supply all labor, supervision, and materials required for installation of all new faregates and supporting equipment. Installation of the new faregates shall include fastening and anchoring the equipment, and, if necessary, the repositioning of electrical receptacles and the extension of power circuits from the kiosk to a faregate cabinet. WMATA will provide power in the vicinity of the communications cabinet. Following NTP, the Contractor shall document all power requirements for the faregates and supporting equipment, and shall provide detailed justification for any power requirements in excess of one (1), 110VAC, 60 Hz, single phase, 15A, circuit.
It is anticipated that the Contractor will use existing power twist lock receptacles inside the current faregates. In the current faregate configuration, some end gates do not require power inside the cabinet. If in the new faregate configuration, power is required to a cabinet that is not equipped with a power receptacle the Contractor will be required to install the replacement power circuit. WMATA will provide wiring for the electrical circuit between the electrical panel and the kiosk. The Contractor will be responsible for extending the wiring to the faregate and terminating the receptacle.

Additionally, the power receptacles inside the current faregate cabinets have a profile above the floor of approximately 4 inches. If the positioning of the power receptacles are not compatible with the new faregates, it will be the Contractor's responsibility to reposition the receptacles to conform to the faregate design.

The Contractor shall document all power requirements for the field devices not less than 120 days prior to the planned installation of devices. **CDRL 5-8**

Faregate mounting shall be in a secure, robust, and vandal- and burglar-proof manner. Cabinet mountings within the station shall be by means of four (as a minimum) stainless steel, anchor bolts, to be provided by the Contractor, which shall be embedded in the concrete platform by the Contractor according to the bolt manufacturer's instructions.

Documents and drawings detailing design and installation of equipment at each Metrorail Station shall be submitted for WMATA review at the Conceptual Design Review and for approval at the Preliminary Design Review.

5.2.6 AFC Simulator Lab and Other Facility Installations

The Contractor shall submit an installation plan for faregates and all supporting equipment to be installed in the AFC Simulation Lab, Maintenance Training Facilities, Revenue Facility and Parts Repair Shop. Installation requirements may include construction of raised platform to support device wiring. The Contractor shall furnish the platforms onto which hardware shall be installed. The Simulation Lab shall include cabinets for one ADA faregate aisle and 3 regular aisles. The Maintenance Training Facility and Shop shall include cabinets for one ADA aisle and 2 regular aisles. The Revenue facility shall include cabinets for one regular aisle. Installation plans shall document all power and environmental requirements for each facility. **CDRL 5-9**

5.3 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 5-1	Deployment Plan and Deployment Schedule.	5.1	Within 180 days of planned deployment start	Yes
CDRL 5-2	Safety Certification Program Plan and Safety Certification Checklist	5.3.1	Within 120 days of planned deployment start	Yes

CDRL No.	Description	Section	Due	Approval Required
CDRL 5-3	Faregate Interface Plan (IIP)	5.2.1.1	PDR, FDR	Yes
CDRL 5-4	Site Specific Work Plan (SSWP)	5.2.2.2	Within 120 days of planned deployment start	Yes
CDRL 5-5	Supplemental Work Plans	5.2.3	Within 60 days of planned site installation	Yes
CDRL 5-6	Installer Employee Safety Management Program	5.3.6	Within 120 days of planned deployment start	Yes
CDRL 5-7	Equipment Asset Documentation	5.3.5	Updated monthly through deployment	No
CDRL 5.8	Equipment Power Requirements	5.3.7	FDR	Yes
CDRL 5-9	Simulation Lab and Training Facility Installation Plan	5.3.7	FDR	Yes

End of Section 5

6 Training

The Contractor shall provide a comprehensive Training Program to educate and train WMATA to operate, service, support, and maintain faregates and supporting systems at Final Design Review.
The primary objective of the Training Program shall be to provide the Transit Agency with the materials, knowledge, skills, and information necessary to correctly operate, maintain, and troubleshoot the installed faregates.

This training program shall incorporate two training methodologies:

A. Training sessions provided by the Contractor directly to designated staff to enable Transit Agency training staff to perform subsequent training in a train-the-trainer manner; and
B. Training sessions provided by the Contractor directly to designated personnel.

Training courses shall include the following:

- Maintenance training including system monitoring, preventative maintenance, field corrective maintenance and bench level parts maintenance;
- Operations training including station level faregate operation and management centralized faregate management; and
- Faregate system reporting.

6.1 General Training Requirements

The Contractor shall be responsible for the following:

A. Course development and modification;
B. Providing qualified instructors;
C. Generating and supplying handouts, presentations, manuals, classroom aids and training aids;
D. Supplying training materials for each trainee for each training session;
E. Conducting the necessary training sessions for each phase of deployment;
F. Providing training tests to verify proficiency;
G. Providing follow-up training sessions as required prior to completion of training for each phase;
H. Documenting, via DVD, a minimum of one of each of the different training sessions provided.

Training shall be provided by the Contractor to bring WMATA-designated personnel to the level of proficiency required for performing their respective duties.

WMATA training personnel who will be responsible for training other WMATA-designated personnel shall also receive instruction designed to enable them in turn to provide training of all types of WMATA-designated individuals.
The Contractor shall assume no knowledge of the features of the faregates and supporting systems on the part of the WMATA-designated personnel, and shall design the training program to bring the level of student knowledge to one fully adequate for the objective. The Contractor may assume that all personnel possess the basic qualifications of their positions.

All training materials shall be in English and shall use English measurements. Classes will be split covering both Theory of Operation, emphasizing element interrelation and element design, in the classroom, and practical "hands-on" training using the actual equipment, systems, and software where appropriate. Hands-on training shall be provided for all lessons that involve all aspects of the system operation, maintenance, troubleshooting, setup, modification, and other similar functions that are required for faregate operation and maintenance.

Instruction shall be tailored to the specific needs of each class of personnel to be trained or familiarized on the system and equipment; e.g., maintenance-related emphasis for technicians; station operations related emphasis on faregate operation and site configuration; general overview for executive management.

6.2 Instructor Qualifications

The Contractor shall provide experienced and qualified instructors to conduct all training sessions at locations designated by WMATA and agreed with the Contractor.
All instructors conducting these training courses shall be familiar with the relevant technical information and able to utilize proper methods of instruction, training aids, audiovisuals and other materials to provide for effective training. Instructors shall have performed similar training for other transit clients and shall have a proven, positive record of accomplishment.
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6.3 Training Program Plan

The Contractor shall submit a Training Program Plan for review by WMATA at the start of the Preliminary Design Review for the initial deployment phase and not less than 90 days prior to commencement of deployment of additional functionality in subsequent phases. **CDRL 6-1** The training program plan shall include the following information, as a minimum:

6.3.1 Program Description

The Contractor shall provide a narrative description of the overall approach to the training program, including the following:

A. General description of the training program;
B. Identification of all training courses to be provided;
C. Summary course descriptions;

D. Targeted trainees of each session;
E. Maximum number of trainees for each session;
F. Objectives of each class;
G. Sequence of training activities;
H. Training schedule;
I. Equipment required to facilitate each training session.

6.3.2 Training Schedule

A schedule shall be included in the training program plan. It shall take into account the training sequence, hours of instruction required for each class, number of personnel to instruct and desired classroom size, and the requirements identified in Section 6.1. Classes shall planned for the following user groups:

- Field Maintenance Technicians;
- Bench Level Maintenance Technicians;
- Station Managers; and

Other Users (Managers, ROCC Supervisors, IT Applications)
Field Maintenance classes shall include all faregate preventative and corrective maintenance skills as well as faregate management and system monitoring applications. The classes shall be conducted on both day shift and evening shift. Classes shall include participation for Technicians, Supervisors and Trainers. Class size shall not exceed 8 participants per class. Contractor should assume 11 sessions of each class with 7 during the day shift and 4 during the evening shift. Contractor shall also include 4 sessions of refresher training to be conducted within 30 days of the end of the maintenance warranty period.

Bench Level Maintenance classes shall include all skills necessary to test and repair faregate modular parts and components. Bench level maintenance classes will be conducted during the day shift with a class size not to exceed 5 participants. Contractor should assume 2 sessions of each class. Bench Level Maintenance classes shall also include refresher trainer sessions to be conducted within 30 days of the end of the warranty period.

Station Manager Classes shall include all the skills necessary for both field and remote faregate operation including field level resets and fingertip maintenance. Station Manager Classes shall be designed for WMATA Trainers who will conduct further training to Station Managers. Classes shall not exceed 8 participants per class. The Contractor should assume 3 sessions of each class.

Other User classes shall include all of the skills necessary for system monitoring and reporting applications. Classes shall not exceed 20 participants. Contractor shall assume 4 sessions of each class.

The Training Schedule shall include:

A. The title of the training to be provided;
B. A general description of the training curriculum;
C. Intended audience; class size;
D. WMATA facilities required (e.g., classroom size, shop requirements; sequence and timing of classroom, shop and field instruction and estimated hours required for each);
E. Number of sessions and the hours per session;
F. Prerequisite activities that must be completed in advance of the training; and
G. Any other information to facilitate planning for and completion of the training program for each deployment phase.

6.3.3 Course Description

For each training course identified in the program description, the Contractor shall provide the following:

A. An outline of course content and learning objectives;
B. Prerequisite skills and knowledge of course trainees;
C. Training methods to be used (e.g., classroom presentation, hands-on practice, paper and pencil exercises, etc.);
D. Methods and criteria for evaluating performance, including an objective grading system to report progress of trainees during the training;
E. Resources to be provided by Contractor, e.g., system equipment and software, handout material, audio-visual equipment, digital video recorders (for documenting at least one class of each training course), testing apparatuses needed to simulate operating conditions;
F. Resources required from WMATA, including classroom, field and shop space; facilities and other necessary items;
G. Approximate time, in days and hours per day, required for classroom and field training for each course.

6.3.4 Training Course Curricula and Materials

The Contractor shall submit course curricula and training materials for approval by WMATA. **CDRL 6-2**

No training shall occur until such training materials have been approved by WMATA. Training curricula shall be submitted to WMATA for review and approval purposes not less than ninety (90) days prior to commencement of any training, and no class will be considered officially scheduled until the materials for that class have incorporated WMATA's submitted changes and additions.

The training material for each course shall include the following:

A. **Course Outline and Lesson Plan:** Lesson title, learning objectives, instructing sequences (outline), tests, trainee competency pass/fail criteria, summary, and testing matrix linking each test question to a specific learning objective. Maintenance courses shall minimally include sections devoted to theory of operation, general maintenance, system fault analysis, troubleshooting and repair. Operations courses shall minimally include sections devoted to equipment layout, operational functionality and troubleshooting problems in support of customer assistance.

B. **Instructor Guide:** Used initially by the Contractor instructors, the Instructor Guide shall be in sufficient detail to enable WMATA training personnel to present the course again at a later time to, in turn, train additional training personnel, newly hired or newly assigned WMATA-designated personnel and shall include a check sheet, such that instructors can check off each essential element of training as it is completed, and submit the check sheet as a part of the course record.

They shall include as a minimum, schedules for each course, outlines for the training modules, lesson plans, durations of each module, target audience and pre-requisites for each course, objectives, sequential lists of training materials, including instructions on how to present any working models or advanced technology training aids, copies of training aids for presentation (and hard copies for annotation), skills inventories (with answers), references to support materials, and any additional information deemed necessary for accurate reconstruction of the course.

The Instructor Guide shall include instructor's notes explaining the methodology to be used for a particular section and information to be emphasized. Particular attention shall be paid to safety concerns or dangers within the equipment. The lesson plan shall indicate when training aids will be used, or referred to, during the course instruction.

The Instructor's Guide shall note references to the Student Guide. The Instructor Guide shall be reissued and shall include a copy of all information and materials used during the training sessions.

C. **Student Guides**: Student Guides shall be in addition to any manuals provided to participants. The Guides shall include notebook-sized copies of any training aids used by the instructor, including transparencies, annotated schematics, selected screen shots from technology-based training, and key clips from video footage.

The student guide shall also contain descriptive information, drawings and procedures for trainees to refer to during training courses and to assist them in achieving competency in their assigned duties. The student guide shall provide comprehensive information on all aspects of training as identified for each course and may include sections of draft manuals for clarity.

D. **Classroom Training Aids**: Classroom training shall make optimum use of Training Aids which shall include any Power Point presentations as approved by WMATA, slides, posters, annotated enlargements of schematics, videos, working models, cutaway diagrams, cutaway views or sectioned sample hardware, custom simulators, computer-based training modules, interactive video or other appropriate technology-based training, and one installed piece of each type of equipment to be installed at WMATA.

The Contractor shall provide three-dimensional drawings/renderings of faregate equipment arrangements in electronic format, as approved by WMATA.

The Contractor shall provide all testing apparatuses and tools needed to perform training skills. The Contractor shall provide costume simulators to simulate faregate functions and failure conditions and sample component parts such as barrier actuators and printed circuit boards to aide in training instruction.

Power Point presentations for use with laptop computer and HDMI digital display and shall illustrate subassemblies showing component locations, component cutaways, schematics, and wiring diagrams. Power Point presentations depicting data and communications systems shall be animated and include direction of flow for the particular data element.

All illustrations/diagrams/photographs shall display faregate equipment in 3-D animation, as they would be seen from the viewpoint of a person actually performing the test, troubleshooting or doing the repair. Any diagrams shall be displayed with sufficient scale and clarity to permit all to see clearly.

E. **Location:** Unless otherwise indicated, all training sessions shall be provided at WMATA-provided locations in or near the WMATA operations area. .

F. **Times:** Class times shall be scheduled by the Contractor at least 30 days in advance of each class and shall be subject to WMATA approval.

Training materials shall be kept consistent with system design and documentation, including manuals and drawings. Any updates to the system elements or procedures shall be reflected in the training materials and course curriculum through the completion of the training program, through all deployment phases.

All training materials shall become the property of WMATA at the conclusion of the training course. WMATA will retain all rights for use, modification, and reproduction in conjunction with the accomplishment of WMATA Training Objectives. All training submissions and schedules shall be subject to approval of WMATA.

At the completion of all training courses, for all training materials delivered to WMATA, in addition to the final electronic versions of the training materials, Contractor shall provide fully editable versions of all training materials in Microsoft Office format. **CDRL 6-3** WMATA reserves the right to reproduce and modify these materials for its own use without restriction.

Contractors shall also provide two electronic copies of the training materials for each training class that are readable and reproducible in hard copy using the latest release of Microsoft Office Word available for usage by the general population or WMATA-approved equivalent software. **CDRL 6-4**

6.4 Required CDRLs

The following CDRL items are referenced in this Section.

CDRL No.	Description	Section	Due	Approval Required
6-1	Training Program Plan	6.3	FDR	Yes
6-2	Training Course Curricula	6.3.3	PDR, FDR	Yes
6-3	Training Materials Hard Copy and Training Tools and Aides	6.3.4	Completion of course	No
6-4	Training Materials – Electronic Copies	6.3.4	Prior to course	No

End Section 6

7 Program Management and Interface Control Document (ICD) Support

7.1 General

This Section specifies the requirements for program management. The management shall be sufficiently comprehensive to enable WMATA to ascertain, with a high degree of confidence, that the Contractor will meet requirements and enable WMATA to monitor the contractual effort.

The Contractor shall establish an organization to properly manage the faregate design, testing, manufacturing, deployment, and warranty. The organization shall be highly responsive to the needs of WMATA as required in this Contract and shall be subject to approval by WMATA.

The Contractor shall use the cloud based program management tool, Procore to manage all project documentation, reviews, correspondence, and submittals. This website shall be accessible by authorized WMATA project staff and authorized Contractor staff with access rights controlled by WMATA. Unless otherwise identified, all project documentation and information shall be loaded to and maintained by this secure document review and sharing system. Should the performance of any individual within the Contractor's project team not meet the expectations of WMATA, the Contractor shall replace the individual with one approved by WMATA. This change in the Contractor's project team shall not adversely affect the development, implementation, installation, and acceptance schedule as defined and shall require no modifications to compensation to the Contractor.

7.1.1 Project Manager

The Contractor shall designate a responsible individual on a full-time basis, fluent in English and subject to approval by WMATA, to serve as Project Manager for the entire term of the project. This individual shall have prior experience in management of large, integrated system procurements and be familiar with design, system integration testing, equipment manufacturing, and deployment and in a transit environment.

This individual shall be granted full authority to render decisions on behalf of the Contractor pertaining to technical and commercial decisions on the Project. The Project Manager shall serve as the Contractor's representative in all meetings with WMATA and/or their duly appointed representatives.

The Project Manager shall represent the Contractor during progress meetings, design review meetings, warranty coordination meetings, contract change negotiations, and open item meetings with WMATA and with the Project Manager's supporting staff, be capable of addressing all issues on the agenda for each scheduled meeting. The Project Manager shall arrange to have supporting staff members available for participation in these meetings, as required.

The Contractor shall provide adequate project staff assigned to the project throughout the term of the Contract to ensure that proper and timely responses can be made to WMATA

requests and to ensure that the system is designed and deployed according to the project schedule.

The Project Manager shall ensure that all elements of the design, development, and deployment meet the technical and contractual requirements, including:

- Ensure that the project tasks are completed on time and within budget;
- Coordinate design and engineering activities;
- Furnish all submittals to WMATA;
- Be the sole point of contact between WMATA and the Contractor's project team, unless otherwise mutually agreed between the Contractor and WMATA;
- Keep WMATA fully informed of the status of the project;
- Participate in monthly project status meetings at WMATA;
- Promptly notify WMATA of any problems or difficulties that may affect the timely or effective completion of the project or any scheduled deliverables.

The Project Manager shall be responsible for support provided by personnel or groups outside the project team during the period of performance for this contract, and shall have full authority to assign task priority as needed to meet the requirements of the project.

Removal or replacement of the Project Manager by the Contractor shall only be with the consent of WMATA upon written notification from the Contractor, describing the reason for removal or replacement.

WMATA reserves the right to request the Project Manager to be replaced with written notification provided to the Contractor. When notification is received, the Contractor shall replace the Project Manager and this replacement shall be subject to approval by WMATA.

7.1.2 Management Plan

Within 30 days of NTP, the Contractor shall submit a Management Plan to WMATA for approval. **CDRL 7-1** The Contractor's Management Plan shall be sufficiently comprehensive to enable WMATA, with a high degree of confidence, to verify that the Contractor will meet the stated requirements, and to enable WMATA to monitor the contractual effort through all stages of project implementation and warranty.

The Management Plan shall be updated as necessary to incorporate all changes in the project, its implementation, or its schedule. The plan shall include:

A. An organization chart including a definition of levels of responsibility and authority within the Contractor team, and qualifications of all personnel therein.

B. The methods and communications to be used to control the program schedule, design reviews, technical performance, program changes, subcontracts, purchase orders, material procurement, in-service support, warranty, systems assurance analysis, tests, and demonstrations.

C. A Submittal List and Schedule listing drawings, documents, and data to be submitted for review and approval during the design review phase of the program, and a schedule for the submittal of this information.

D. WMATA requires that the Contractor develop an updated and complete Contract Deliverables Requirement List (CDRL) based on the requirements identified in each Section of the requirements. . Submittals include, but are not limited to, schedules, plans, procedures, reports, certificates, samples, certifications, test results, and as-built drawings. The CDRL list shall be in accordance with the following column headings:

1. Item Number;
2. Deliverable Description;
3. Requirements Reference Paragraph (i.e. location of requirement within the Contract Documents);
4. Scheduled Delivery Date(s);
5. Current WMATA approval status (i.e., pending, approved, conditionally approved, disapproved);
6. Quantity: Number of documents, units, or copies required.

Every CDRL shall be updated to reflect the changes in design throughout the design, implementation, and warranty period so that the final set of CDRLs delivered at the end of the project shall represent the system design in place at the conclusion of the contract.

E. The PMP shall include early support and collaboration for the development of the ICD to be delivered by the System Integrator. The contractor shall in addition review the 60% design of the ICD and provide feedback.

7.1.3 Risk Management Plan

Within 60 days of NTP, the Contractor shall submit a Risk Management Plan to WMATA for approval. **CDRL 7-2** The purpose of the Risk Management Plan is to identify and manage potential risks that threaten to increase project costs, lengthen the project schedule or compromise project performance. The Risk Management Plan shall include the formal four-step process that includes Risk Planning, Risk Identification, Risk Analysis, and Risk Control. The Risk Management Plan shall list the risk assessments for all deliverables and all major tasks defined in the Master Program Schedule, including impact assessments and risk mitigation plans for high risk deliverables and major tasks. The Risk Management Plan shall include an associated Risk Management Process that

continues throughout the project with the monitoring of potential risks and a well-planned response to correct problems as they occur.

7.1.4 Master Schedule

Within 60 days of NTP, the Contractor shall submit for WMATA's review and approval a Cost Loaded Master Program Schedule in accordance with the requirements of the Contract **CDRL 7-3** The Master Program Schedule shall cover all phases of the work but will only present a high level overview of faregate deployment tasks. The Master Program Schedule shall incorporate into its task the items from the Systems Integrator schedule. It shall include the following:

A. Work item descriptions that convey the scope of work indicated. Work items shall be discrete items of work that will be accomplished under the Contract. Work items shall include the scheduled dates for submittal and required response dates for approval of Contractor drawings and documentation. Work items shall also include specific line items for all defined Milestone Payment Schedule payment events from the Contract Milestone Payment Schedule. It shall include the schedule for design reviews, procurement of materials and equipment, fabrication of materials and equipment and their installation and testing, delivery of WMATA-furnished and other third party items and information, qualification tests and delivery, and testing of faregates and supporting systems. Estimated work item duration in whole working days shall be indicated for each work item of the schedule.

B. The sequence, successor, and predecessor interrelationships among work items shall be considered in developing the schedule and shall be included as indicated.

C. Work item descriptions shall be accompanied by narrative explanation of what the work item comprises and the basis for the estimated work duration.

D. Sufficient detail shall be provided to indicate the manufacturing, testing, shipment, storage, and installation of faregates.

E. Sufficient detail shall be provided for the analysis, design, build, test, and implementation of faregates.

F. The Contractor's initially submitted schedule that is approved by WMATA shall become the Base Line schedule. Subsequent schedule updates shall show performance against the original Base Line schedule.

G. The Contractor's schedule shall include work breakdown activities of sufficiently short duration to facilitate adequate tracking of each activity by both the Contractor and WMATA.

H. All versions of the Master Program Schedule shall be submitted in both Primavera 6 and PDF formats.

7.1.5 Deployment Schedule

Within a minimum of 120 days prior to the planned start of faregate deployment tasks, the Contractor shall submit for WMATA's review and approval a Cost Loaded Deployment Schedule in accordance with the requirements of the Contract. **CDRL 7-4**

A. Work item descriptions for each area of deployment including but not limited to equipment delivery and staging, demolition of current equipment, installation, testing, and warranty maintenance period. It shall include the mezzanine ID.
B. The sequence, successor, and predecessor interrelationships among work items and locations shall be included as indicated.
C. Work items shall distinguish deployment planning tasks such as SSWP and Safety Certification from installation tasks.
D. The Contractor's initially submitted deployment schedule that is approved by WMATA shall become the Base Line Deployment Schedule. Subsequent schedule updates shall show performance against the original Base Line schedule and to verify deployment payments.

7.1.6 Monthly Progress Reports

The Contractor shall submit to WMATA a monthly progress report by the fifth day of each month that covers activities for the previous month. **CDRL 7-5**
Monthly progress reports shall include:

A. Updated Master Program Schedule highlighting the following items against the approved Base Line Schedule:
    1. Actual completion dates and start dates for activities completed during the report period;
    2. Estimated remaining durations for activities in progress;
    3. Estimated start dates for activities scheduled to start;
    4. Changes in the durations of activities (logic changes to the Master Program Schedule may not be made without WMATA's approval);
    5. Narrative explanation of the cause of any schedule slippages, and identification of workarounds needed to make up for schedule slippage, as necessary;
    6. Activities not previously included in the master program schedule;
B. Updated Deployment Schedule highlighting the start and completion dates for each Metrorail Mezzanine during the report period and changes in planned sequence of deployment.

C. Updates to the Risk Management Plan showing existing or anticipated problems or issues and the proposed work-around to address the issue, and updates to the risk assessment of each active task and open deliverable and updated risk mitigation plans for high risk tasks and deliverables;
D. Updated CDRL list, including current status of all deliverables and risk assessments for all open deliverables;
E. Updated Submittal List and Schedule, including current status of all submittals;
F. Updated action item log showing current status of all action items; and
G. Updated Correspondence Log showing all project correspondence and anticipated response dates for open items of correspondence
H. Updated Badged Employee Log showing all contractors that have been issued WMATA Contractor badges and the expiration date of the badge.

The Contractor shall also provide a narrative which shall state the work actually completed and reflect the progress in terms of days ahead of or behind the specified dates for each of the work items, as well as percent completed.

During the manufacturing, assembly, and testing phases, the Contractor shall supplement the narrative with digital color photographs to show the status of the work in progress and any problem areas. WMATA may request supplemental details and photographs if the monthly progress report is determined to be inadequate.

7.1.7 Action Item Log

The Contractor shall maintain a log of all identified action items through the time of project completion. These action items shall be identified at design review meetings, Progress Review Meetings, and through correspondence. All action items shall have a responsible party assigned. No action item shall be assigned to WMATA without WMATA's knowledge and concurrence. Each action item in the log shall contain:

A. Item Number;
B. Description;
C. Requesting Party;
D. Assigned Party;
E. Status (open / closed / in progress / deferred / etc.);
F. Date Opened;
G. Date Closed; and
H. Progress Notes.

The current action item list shall always be posted on the web-based document control system, and available to authorized WMATA project team members.

7.1.8 Correspondence Log

The Contractor shall maintain a log of all project correspondence through the time of project completion. All correspondence items shall have a responsible party assigned. Each correspondence item in the log shall contain:

A. Letter Number;
B. Description;
C. Requesting Party;
D. Assigned Party;
E. Status (open / closed / in progress / deferred / etc.);
F. Date Opened;
G. Date Closed; and
H. Progress Notes.

The current correspondence log shall always be posted on Procore.

7.1.9 Contract Start-up Meeting

Within 30 days after NTP, a Contract Start-up Meeting shall be held in the offices of WMATA. In attendance shall be WMATA, the Contractor's project manager, and other appropriate WMATA and Contractor personnel. The Contractor shall prepare an agenda for the meeting and, within five working days of completion of the meeting, the Contractor shall distribute draft meeting minutes. The Contract Start-up Meeting shall permit all parties to the contract to understand the overall schedule, terms and conditions, scope of work, and responsibilities. In addition, the parties shall discuss and identify the items to be submitted for the design reviews.
The Contract Start-up Meeting shall allow the Contractor and WMATA to coordinate their activities. At the meeting, the Contractor shall also present its intended design and identify interface requirements.

The Contract Start-up Meeting shall also cover the following topics, which shall be addressed in the agenda prepared by the Contractor:

A. WMATA and Contractor to review and confirm the procedural requirements of the Contract;
B. Contractor to provide conceptual information on proposed equipment design, configuration, and layout;
C. WMATA and Contractor to review intended operations and maintenance requirements;
D. WMATA and Contractor to identify interface requirements between faregates, PPTs, and WMATA's current fare payment application;
E. Contractor to identify initial information and decisions required from WMATA; and
F. Contractor to identify any requirements for which waivers will be requested.

7.1.10 Progress and Quality Review Meetings

Progress and Quality Review Meetings shall be held at least once a month, at the offices of WMATA.

The Contractor shall prepare and distribute an agenda to all participants expected to attend the meetings seven days prior to the scheduled meeting date. The Contractor's Project Manager and Quality Manager shall attend and chair these meetings.

7.2 Contractor's Quality Assurance Program

7.2.1 General

The Contractor shall establish and maintain an ISO 9001 compliant project specific Quality Assurance/Quality Control (QA/QC) system consisting of a program quality manual and supporting plans and procedures. These shall address the methods to be used to control the quality related aspects of all component, assemblies, software, and applications to be furnished and installed in accordance with the Contract Documents. The Contractor shall be responsible for the quality of all its work and the work of its subcontractors, and shall ensure that the pertinent requirements for the achievement of quality are included in all relevant sub-contracts. As such, the QA/QC system shall be imposed both upon all entities within the Contractor's organization and on all subcontractors whenever Contract work is performed.

The QA/QC program shall include a description of the organization and shall identify the responsibilities and accountabilities of all personnel performing quality-affecting activities. The Quality Control plans and procedures shall include and reference those checklists and test and inspection forms to properly document the activities performed to achieve the quality of the Work.

7.2.2 Contractor Quality Assurance Program Plan

The Contractor shall prepare and submit for approval a Quality Assurance Program Plan that addresses control of the quality of the Contractor's design, equipment furnished, installation workmanship, testing, training, and documentation. This Plan shall also include Reliability Assessment Program elements.

A QA Program Plan shall be submitted to WMATA within 60 days after NTP for review and approval. **CDRL 7-6** No manufacture of equipment or components shall be permitted by the Contractor until the QA Program Plan is approved by WMATA.

The Contractor shall use and abide by the QA Program Plan to execute the work for the Contract. The QA Program Plan shall describe the methods for planning, implementing, and maintaining quality, schedules, and cost. The QA Program Plan shall contain a company policy statement that clearly defines the responsibilities of QA personnel. An organization chart shall be included to show the reporting relationships of all QA staff, and shall indicate the Contractor's QA/QC representative, who shall be a full-time employee of the Contractor. The QA/QC representative shall not report directly to the

Contractor's Project Manager, but to a higher-ranking executive within the Contractor's organization.

The QA Program Plan shall also contain a collection of all forms to be used for the documentation of quality control activities, which assure compliance of materials, processes, personnel, and products to the applicable specifications.

The QA Program Plan shall at minimum, include procedures for the following activities:

A. Factory inspection and test processes and record maintenance.
B. Configuration Management Program, procedures, and records for Change Control and version management for both hardware and software. Changes shall include the following:
    1. Fixes: corrections of malfunctions ("bugs") that are required in order to meet functional requirements as specified in this specification.
    2. Updates: new software releases provided by the Contractor, whether for application software, operating system software, or third party software.
    3. Enhancements: changes that provide improvement in the operation.
    4. Modifications: changes necessitated by program changes.
    5. Upgrades: augmentation and/or replacement of any system hardware.
    6. Documentation revisions: updates to instructional documents or user's guide to reflect modifications to any existing software or other changes to systems' functionality.
    7. Any other modifications to the hardware or software not specifically identified above.
C. Procedures and records for equipment handling; inventory; storage; delivery; design control; changes to documents; drawings; data; and specifications; release for shipment; shipping; evidence of compliance; corrective action; calibration/verification of measuring equipment and audit.
D. Software Development Quality Assurance Program, consistent with that indicated in IEEE Standard 730, IEEE Standard for Software Quality Assurance Plans or equivalent ISO 9001 standards for software quality assurance. At a minimum, the Software Development Quality Assurance Program shall include a Test Plan for quality assurance testing of each Contractor Software Deliverable prior to installation and testing pursuant to Section 19, including details for:
    1. Testing of individual units of source code to determine if they meet the applicable specifications, function as intended or are otherwise fit for the intended use ("Unit Testing").

2. Combining units of source code that have completed Unit Testing and testing the combined units as a group to confirm that all components interact correctly, including verifying functional, performance, and reliability requirements placed on major design ("Integration Testing").
3. Testing conducted on a complete, integrated system (i.e., combined components that have completed Integration Testing and that have been integrated with applicable hardware systems) to evaluate the system's compliance with its functional specifications and any other specified requirements ("System Testing").
4. Testing conducted to uncover new bugs, or regressions, in existing functional and non-functional areas of a system after changes, such as enhancements, patches or configuration changes, have been made to the system to ensure that a change in one part of the system, such as a bug fix, did not introduce new faults in other parts of the system ("Regression Testing").
5. Sets of instructions that will be performed on the unit or system under test to test whether the unit or system functions as expected ("Test Scripts").
6. Short programs written in a programming language used to automatically test part of the functionality of the system ("Automated Test Tools").
7. Entry and exit criteria for User Acceptance Testing ("UAT").

E. Quality Assurance program requirements for subcontractors.
F. System installation, inspection, and test processes and records.
G. Surveillance over all work, including subcontractors, for conformance and verification thereof with all Contract requirements.
H. Discrepancy control.
I. Evaluation and assessment of subcontractors' QA programs.
J. Feedback of problems, their resolutions to the Contractor's engineering and production departments, and corrective action.
K. Qualification and certification of all personnel performing work for this Contract.

7.2.3 Faregate Deployment Project Specific Quality Management Plan

As part of the QA/QC program for this project, the Contractor shall:

A. Engage an adequate number of skilled professionals who are thoroughly trained, experienced, and familiar with the specific requirements and methods needed for the proper performance of the work.
B. Establish technical and administrative surveillance and/or audit methods to ensure the highest degree of quality, and to correct potential problems without affecting the Contract schedule.

C. Verify that the required quality control inspection, testing, and documentation activities have been performed to assure that the equipment, materials, and construction comply with the requirements of the Technical Specification.

D. Monitor quality control over suppliers, manufacturers, fabricators, products, services, site conditions, workmanship, and installation to produce work of the highest quality.

E. Take corrective actions in a timely manner to identify undesirable conditions affecting the quality of Work and the contract schedule.

F. All test results shall clearly include a statement that the item tested or analyzed conforms or fails to conform to the contract requirements. Each report shall be conspicuously stamped on the cover sheet in large red letters a minimum of ½ inch high "CONFORMS" or "DOES NOT CONFORM" to the Specifications as the case may be.

G. All test reports shall be signed by a testing laboratory's authorized person and countersigned by the Contractor. The Contractor shall provide all tests, reports, certifications and other documentation to the Project Manager promptly after the completion of tests.

H. The quality assurance functions shall include, but not be limited to:

1. Contract Review
2. Document Control
3. Procurement
4. Shop Fabrication
5. Field Fabrication
6. Field Installation
7. Field Assembly
8. Receiving Inspections
9. Final Inspection
10. Software Controls
11. Factory and Field Testing
12. Handling and Storage
13. Packaging and Shipping
14. Quality Records
15. Non Conformance Reporting
16. Corrective Action(s)
17. QA Audits
18. Training
19. Control of In Process Activities
20. Systems Controls

I. The Contractor shall promptly reject work, which does not comply with the requirements of the Contract Documents. If the Contractor elects to propose that WMATA accept work that is nonconforming, the Contractor shall reimburse WMATA for the costs associated with the review of the nonconforming work by WMATA's Project Manager.

J. Develop quality assurance forms in a format acceptable to WMATA for all major elements of the work including any additional elements.

The certified quality assurance documents shall identify and include any changes made to the material, manufactured product or fabricated item as compared to the Contract requirements and approved shop drawings. The Contractor shall describe as to how each change will affect the installation, space, and subsequent operations.

7.2.4 Deployment Project Specific Quality Management Plan (PSQMP)

The Contractor shall develop a project specific Quality Management Plan based on FTA-IT-90-5001-02.1 QA/QC guidelines for the deployment of faregates in the Metrorail system. The Deployment PSQMP shall include:

A. Document quality management responsibilities for the deployment of faregates and the roles and responsibilities of the Contractor and all Subcontractors supporting deployment;
B. Document deployment quality planning and quality control measures for all devices and deployment tasks;
C. Document quality measures for installation tools and material quality control measures and purchasing;
D. Document quality measures for the management and control of installation testing, inspection, and deliverable management;
E. Document process controls to ensure consistent completion of installation tasks;
F. Document Inspection, measuring and testing of installation equipment;
G. Document procedures for site quality inspections, nonconformity reporting and management of corrective actions;
H. Document project specific quality records and records management procedures; and
I. Document any training and certification requirements for equipment installers.

WMATA's review of certified quality assurance documents and inspections shall not relieve the Contractor from its "primary" responsibility for the quality of work. **CDRL 7.7**.

7.2.5 Faregate Warranty Management

A warranty shall be provided for all hardware and software required to provide for proper operation of faregates. The Contractor shall submit a Faregate Warranty Management Plan describing Contractor support resources, procedures, organizational chart, and contact information to meet warranty requirements. **CDRL 7.8.**

Contractor warrants that commencing upon the date of Final Acceptance through its termination, the faregate hardware and software will be free from defects and failures in material and workmanship and function properly, including updates, new releases and other software used to support faregate operations and fare payments.

A “defect”, “malfunction” or “failure” shall mean any condition, whatsoever the cause, whereby any element , system or sub-system, either third-party or Contractor developed, shall require maintenance, correction or repair or otherwise fail to conform to the Technical Specification requirements other than:

- Scheduled maintenance recommended by The Contractor and accepted by WMATA, and
- Maintenance, repair or correction resulting solely from causes beyond the control and without the fault or negligence of the Contractor, its employees, agents, sub-contractors or suppliers, including failure of WMATA to perform scheduled maintenance recommended by the Contractor.

Contractor shall remedy any failure, malfunction, defect or other non-conformity exhibited faregate hardware and software furnished to WMATA for 90 days after system acceptance.. After the period, the Contractor shall continue make corrections and modifications to the software and shall replace or repair all parts and modules that are replaced by WMATA technicians. The Contractor shall be available to WMATA immediately upon discovery of errors. Contractor shall notify WMATA whenever corrections, modifications or revisions of System hardware and software are available. Corrections shall be performed as follows:

Through faregates deployment and during the initial 90 day maintenance warranty, the Contractor shall respond and render continuous effort to any request for service due to a hardware or software failure, malfunction, defect or non-conformity by telephone response by a qualified and knowledgeable representative within sixty (60) minutes.

- If such software failure, malfunction, defect or non-conformity cannot be remedied by such means within two (2) hours of receipt of such request, the Contractor shall formally notify WMATA of the ongoing issue and efforts to remedy the failure, malfunction, defect or non-conformity.
- If Contractor reasonably believes correction or repair shall take longer than eight hours to complete, then the Contractor shall provide written notice to WMATA of this condition, along with a preliminary plan for how the Contractor intends to make the repair or correction, and an estimate of the time to repair or correct.

Until such time as the repair or correction can be completed, the Contractor shall use best efforts to keep the faregates as fully functional as possible. Failure by Contractor to comply with the provisions hereof may be deemed by WMATA as a material breach of Contractor's obligations hereof.

When software updates become available, either third party or Contractor-developed, Contractor shall provide all effort, training and support required to install such updates

and to convert and reformat any WMATA data, if necessary. Without releasing Contractor from its obligations for warranty, support and maintenance, WMATA has the right to refuse to install any such updates, at its sole discretion.

7.3 Design Reviews

A comprehensive program of submittals and reviews shall be conducted for all aspects of the project. Three design reviews shall be held: Conceptual, Preliminary, and Final. For each of these reviews, a series of documentation, samples, and demonstrations shall be submitted to WMATA for review and approval.

During these design review meetings, action items shall be identified, with each action item assigned to an individual for disposition by a pre-determined response date. All action items identified during the design reviews shall be recorded in the project action item log for WMATA review and approval. **CDRL 7-9**

Attendance at design review meetings shall include representatives of the Contractor and appropriate Subcontractors and WMATA-appointed representatives.

7.3.1 Review Procedures

The Contractor shall submit drawings, documents, procedures, and data in accordance with the Submittal List and Schedule provided in the Master Program Schedule. The Contractor shall submit for review and approval 15 copies of all documents, data, assembly and installation drawings required to convey concept, design, dimensions, maintenance, operation, and overall assembly aspects and interfaces required as a part of these design reviews. Drawings shall be accompanied by material specifications, process specifications, and test data required to permit review and approval of the drawings. Detailed parts drawings need not be submitted unless requested by WMATA to permit review of another drawing.

WMATA reserves the right to reject, without review, any document that is not in English or is not readily understandable due to lack of proper grammar, spelling, sentence structure, or punctuation. WMATA is under no obligation to expend extraordinary effort to interpret poorly written or translated documents.

WMATA reserves the right to request additional drawings, documents, or data, or any combination of documents, drawings, or data to support the review process. At the discretion of WMATA, the Contractor may be issued an extension of time during the review period, should the Contractor have fulfilled the specified submittal requirements, and the additional information requested by WMATA be of sufficient complexity and/or volume. Other contract deliverables including material samples, manufacturing plan, software prototypes and documentation, test plans, test procedures, and analyses shall be submitted in the quantities specified. Parts may be manufactured prior to review and approval of Contractor submittals, however, WMATA reserves the right to refuse or require changes to such parts at the Contractor’s expense should the design(s) fail subsequent review.

Except as provided below, WMATA shall respond to submittals within 21 calendar days after receipt. WMATA shall respond to the Contractor at an address within the United States designated by the Contractor.

As submitted by the Contractor, the drawings, documents, and data shall be accompanied by a letter of transmittal listing drawing and document titles, numbers, and revisions.

The Contractor shall maintain a record of Contractor and Subcontractor submittal status. This shall include drawing and document numbers, revision letter, drawing title, date submitted, transmittal document, disposition, and the document number identifying the disposition. This status shall be updated not less than monthly and submitted to WMATA as part of the Monthly Progress Report.

7.3.2 Approval of Contractor Submittals

WMATA's approval or disapproval will be provided within 21 days of receipt of the entire submittal package in one of the three following categories:

- Approved as Submitted.
- Conditionally Approved. The Contractor may proceed in accordance with changes indicated and shall revise and resubmit the document, drawing, and data until approved by WMATA.
- Disapproved. The Contractor shall revise and resubmit the document, drawing, and data until approved by WMATA.

Approval of the design documents shall be obtained by the Contractor prior to commencement of the design review meetings.

Design approval at any stage shall not relieve the Contractor of the obligation to meet all of the requirements of the Contract, except for those instances when the deviation has been explicitly requested by the Contractor and granted by WMATA. Approval of a document, drawing, and data, which contain deviations from, or violation of, the Contract requirements does not constitute authority for that deviation or violation. Such deviations must be specifically and explicitly requested and granted by WMATA in writing.

7.3.3 Customer Design Inputs

Prior to the commencement of the Final Design Review, WMATA may solicit design inputs from one or more customer groups or representatives. These customer design inputs will not extend the schedule or interfere with any Contract milestone.

As long as the design inputs solicited from the customers do not modify a WMATA requirements and are not explicitly excluded from the faregate design, Contractor shall review the design inputs and within a seven-day time period, identify how these design inputs will be accommodated with any schedule and other impacts identified.

7.4 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 7-1	Project Management Plan.	7.1.2	Within 30 days after NTP	Yes
CDRL 7-2	Risk Management Plan.	7.1.3	Within 30 days after NTP	Yes
CDRL 7-3	Submit the Master Program Schedule	7.1.4	Within 60 days after NTP	Yes
CDRL 7-4	Deployment Schedule	7.1.6	Not less than 180 days prior to the planned start of deployment	Yes
CDRL 7-5	Monthly Progress Report	7.1.6	5th day of every month	Yes
CDRL 7-6	Quality Assurance Program Plan.	7.1.6	Within 60 days after NTP	Yes
CDRL 7-7	Submit Deployment Project Specific Quality Management Plan	7.2.2	Not less than 180 days prior to the planned start of deployment	Yes
CDRL 7-8	Warranty Management Plan.	7.2.5	Not less than 180 days prior to the planned start of deployment	Yes
CDRL 7-9	Design Review Action Logs	7.3	CDR, PDR, FDR	Yes

End of Section 7

8 Warranty and System Support Services

8.1 General

WMATA is interested in exploring options to contract Faregate Maintenance and Parts Maintenance Services. In the base contract, the Contractor shall be responsible for all faregate and supporting system maintenance through system final acceptance (90 days after the completion of device deployment or until all deployment punch list items are closed). Additionally, as part of the base contract, the Contractor shall be responsible for one year parts warranty that covers the repair and replacement all faregate modules and components that are not classified as consumable. Finally, the base contract maintenance services will include 5 years of software maintenance.

At WMATA's sole discretion, the Contractor will be required to provide ongoing maintenance services. Ongoing parts bench maintenance services will begin at the end of the one year parts warranty and extend for a base period of 4 years with an additional 5 one year options. Ongoing field maintenance service (corrective and preventative maintenance) for deployed devices will have an initial period of 5 years with an additional 5 one-year options. WMATA will make the final determination of this option not less than 180 days before planned final system acceptance.
WMATA requires the contractor to transition the responsibilities for these services to WMATA or to another WMATA-approved entity at the conclusion of the performance period of the Support Services Contracts. Accordingly, at the conclusion of the Support Services performance period, the Contractor shall, at no charge, turn-over to WMATA all items used by the Contractor to perform the Support Services defined in this Section, including but not limited to, manuals, procedures, computers, applications, devices, tools and vehicles.

In the event that WMATA does not choose to exercise options for extended maintenance services, the Contractor shall gradually transition maintenance responsibilities to WMATA technicians for the 90 day period after the final faregate has been installed. During this period, the Contractor shall continue to respond to maintenance requests but will oversee diagnostics and repairs done by WMATA staff unless otherwise directed.

Not less than thirty (30) days prior to the expiration of the warranty performance period, the Contractor shall turn-over to WMATA all items used by the Contractor to perform the Support Service including, but not limited to, manuals, procedures, spare parts, consumable parts, and tools. Contractor will have the use of such items until that performance period expires.

8.1.1 Contractor Point-of-Contact

The Contractor shall provide a point-of-contact that can be contacted by WMATA personnel on a 24/7 basis for each of the Support Services performed. The point-of-contact shall be the individual in charge of local Contractor personnel at the time of the call.

The Contractor shall submit a schedule each month of the designated point-of-contact at all times of each day including the phone number for contacting the individual.

8.2 Base Contract Maintenance

During the period of performance where the Contractor is responsible for corrective maintenance service, the Contractor shall have fully qualified technicians on-call during WMATA revenue service hours and shall respond to service requirement within 2 hours of an out of service event. The Contractor will be responsible for all preventative and corrective maintenance on installed devices for a period of 90 days after the devices installation acceptance. Should WMATA choose not to exercise the contract for ongoing maintenance services, the Contractor shall gradually transition device maintenance responsibilities to WMATA employees after the 90 day warranty expires on installed equipment. The Contractor shall submit a Warranty Maintenance Plan detailing staffing plan, communication protocols, and approach to meet requirements. **CDRL 8.1.**
As devices are deployed in the system, the Contractor shall maintain sufficient resources to respond to all service hour corrective maintenance needs and perform all preventative maintenance as per maintenance manuals. The Contractor shall maintain all maintenance records during this period. During this period the Contractor shall be responsible for the local storage and inventory management and control of spare parts. Should WMATA choose not to implement the Ongoing Maintenance Support Option, the Contractor shall turn over all spare parts to WMATA.

The Contractor shall submit a Spare Parts Catalog with the pricing and shipping requirements for each catalog item. The Spare Parts Catalog shall clearly distinguish parts that are repairable from consumable parts that must be replaced periodically or upon failure. **CDRL 8.2**. The Contractor shall also provide recommended spare parts and maintenance consumable items to support one year maintenance service for installed devices. **CDRL 8.3.** At WMATA's sole discretion, the Contractor shall provide continued parts repair and replacement for an initial period of 4 years with an additional 5 one year option periods.

8.2.1 Maintenance Requirements

The Contractor shall maintain faregates in accordance with the requirements of the maintenance manuals. The Contractor shall provide all labor, materials and consumables.

The Contractor shall provide all tools, transportation, test equipment, personnel communications, facilities, and supervision to maintain the faregates and all supporting equipment and systems.
The Contractor shall monitor the faregates from their maintenance facility location via a remote monitoring function. Unavailability of a device shall be reported by the device to maintenance work stations and the ROCC workstation within one minute of the incident occurrence.

The Contractor shall repair and maintain all equipment, regardless of whether equipment failure is due to a component or software fault or is user-induced. Repairs to equipment

damaged because of vandalism or force majeure shall be undertaken by the Contractor on a Task Order basis as part of this contract. The attribution of an equipment failure as an incidence of vandalism shall be subject to mutual agreement between WMATA and the Contractor.

The Contractor shall provide weekly reports on all corrective maintenance actions for the week. This includes reported problems (including source of reported problem and time), corrective action taken (including service technician responding to event and time of action), parts used, and status after response action.
The Contractor shall maintain a schedule of preventative maintenance actions for each device and provide monthly reports detailing the time and date of preventative maintenance actions at each device.

8.2.2 Warranty Period Maintenance Requirements

Through system deployment and for a period not less than 90 days after system deployment or until all punch list items are closed and WMATA issues final system acceptance, the Contractor shall be responsible for all system maintenance. These maintenance activities shall be based on the maintenance information provided in the maintenance manuals provided by the Contractor as well as services needed to address all system corrective action repairs.

Initial Warranty Period tasks include:

- Preventive Maintenance: Perform field and bench-level preventive maintenance on all devices and components installed as a part of the faregates deployment.
- Field and Bench-level Corrective Maintenance: Perform all field and bench-level troubleshooting and repairs on all equipment installed as part of the faregate deployment.
- Emergency Response: Respond on-site to calls from WMATA.
- Maintenance Reports: Submit weekly and monthly maintenance reports detailing corrective maintenance actions and compliance with device preventative maintenance requirements.
- Spare Parts Inventory Management: Manage the inventory of spare parts, materials and consumables that are required for the continued operation of faregates. Bench level troubleshooting, repair and if needed replacements of all parts, modules and systems installed as part of the faregate deployment.
- Software Maintenance and Upgrades: Repair, test and load existing, new, modified or upgraded software, firmware and data tables for the installed faregates.
- Technology Refreshment Services: Perform maintenance and provide software upgrades on all system devices and/or replace devices with new to ensure that all faregates will perform reliably in full revenue service.

The Contractor shall be responsible for the storage and management of spare parts and maintenance consumables through this period. Should WMATA choose not to implement maintenance options and there is a period where WMATA and the Contractor Maintenance Technicians share maintenance responsibilities, the Contractor shall be responsible for the management of all spare parts and materials until parts and materials are officially turned over to WMATA.

Upon completion of the post deployment maintenance period, the contractor shall provide an inventory of spare parts. **CDRL 8-4**. The Contractor shall turn over all spare parts and consumables to WMATA at the end of the 90 day warranty period and be responsible for restoring the spare parts to recommended quantities as established in CDRL 8-3.

8.3 Software Maintenance

The Contractor shall provide software maintenance services for a period of 5 years after system acceptance and, at WMATA's direction, support five additional one year options. This includes all software and firmware installed on faregates, software supporting faregate centralized functionality, software supporting Station Terminals and Station Manager Portable Devices. During this period the Contractor shall be responsible for insuring that all software and firmware, including 3rd Party Software remains fully operational and ensure that patches and updates are installed in accordance to developer recommendations. Software Maintenance services do not include software maintenance for PPT and PV devices, but does include testing and coordination for PPT and PV updates to ensure that faregate applications are not impacted by PPT and PV software changes.

The Contractor shall be on-call 24 hours to respond to emergencies. An emergency is an event in which WMATA is unable to collect revenue. The Contractor shall respond to other software events within 2 hours of a service call during WMATA week day business hours from 8:30 am to 6:00 pm Eastern Time.

The Contractor shall also respond to software changes and system enhancements as requested by WMATA. Per this agreement a labor pool of 1000 Software Engineering and Programming hours will be available to be used at WMATA's discretion for the development and testing of software changes and system enhancements. All other Software Maintenance and support requests will delivered as part of the annual Software Maintenance Agreement which will be invoiced monthly at an agreed upon flat fee.

While the Extended Software Systems Support services are in effect:

- All commercially available software updates (scheduled and unscheduled) for Contractor-developed software shall be provided to WMATA for installation, at their discretion, after independently testing such updates. No hours shall be deducted from the labor bank for these software updates.

- Software updates to correct all software Defects evidenced while installing a change order, and opened by WMATA and accepted by the Contractor, shall be tested and released to WMATA for independent verification and installed at WMATA's discretion.

The Contractor shall provide monthly reports of all software maintenance actions, summaries of software updates and patches, and documentation of the most current software version for all system software and firmware. **CDRL 8-5**

8.4 Optional Ongoing Field Maintenance

At the sole discretion of WMATA, the Contractor shall provide full maintenance services for faregates and other deployed devices. Under this agreement the Contractor shall be responsible for all preventative, corrective and bench level repairs.

The Contractor shall provide qualified on-site technicians that are fully trained and qualified to address all maintenance services required to keep faregates fully functional. The Contractor shall provide sufficient staffing levels to respond to service requests to any WMATA facility with installed faregates within one hour during WMATA service hours from 5:30 AM to 11:30 PM Monday through Thursday, from 5:30 AM to 1:00 AM Fridays and from 8:00 AM to 1:00 AM Saturdays and from 8:00 AM to 11:30 PM on Sundays.

The Contractor shall also be responsible for hiring qualified technicians, training staff and maintaining a fully qualified staffing resources over the period of the contract. All technicians with responsibilities to work on-site must have a WMATA issued Contractor Badge which requires that the pass a criminal background check and have the background check repeated annually in accordance with WMATA requirements. The Contractor is responsible for having criminal background checks completed by an authorized third party contractor.

Should WMATA elect to move forward with this option the Contractor shall maintain possession of spare parts, specialized maintenance tools, and consumables that were purchased under the base agreement and shall be responsible for inventory levels through the contract. At the end of the service agreement the full inventory will be turned over to WMATA.

Contractor technicians shall be granted limited access to WMATA's Maximo Maintenance Software Platform. Technicians will be responsible for logging all preventative, corrective and parts maintenance actions into Maximo daily. The Contractor will also be responsible for providing monthly maintenance reports of all maintenance actions, verified parts inventory, and updated list of active Contractors working on site.

The Contractor shall be responsible for ensuring that all preventative maintenance actions are completed within service recommendations. The Contractor shall be responsible for all parts management including ordering parts, storing parts, and maintaining parts inventory. Since bench level maintenance is included in the base contract, cost for bench

level parts repair or parts replacement shall not be included in the first year of maintenance.

8.4.1 Spare Parts Inventory Management

Spare parts will be replenished through the parts warranty with WMATA. The Contractor shall be responsible for all parts management for bench level parts diagnostics, repairs and replacement. All spare parts will be stored by the Contractor but will remain the property of WMATA and shall be returned to WMATA at the end of the contract term. All spare parts used by the Contractor shall be used in a "first-in first-out" inventory management process.

During the period of this contract, the Contractor shall keep a sufficient supply of spare parts on hand to ensure the unimpeded availability of Faregate equipment. This inventory shall include a sufficient number of operational spares to support timely revenue servicing of the equipment.

The Contractor and WMATA shall jointly inventory the type, quantity, and condition of the spare parts components, modules, consumables, and equipment on hand at the commencement of the Contract. The Contractor shall be responsible for maintaining electronic records of all spare parts, components, modules, consumables, and equipment in an inventory control system. This shall include identification of the location (shop, counting room, at Contractor facility for repair, inventory, technician supplies, armored truck, or equipment unit and equipment type) of all spare parts in WMATA's inventory.

Changes in inventory, including the purchase of replacement parts and the disposal of non-serviceable units, shall be included in the end-of-month reports.

The Contractor shall inspect and test repaired or replaced spare parts as a condition of acceptance upon delivery to ensure that the products meet the requirements of the Faregate Technical Specification.

At the conclusion of this contract, the Contractor and WMATA shall again inventory the type, quantity, and condition of spare parts. It shall be the Contractor's responsibility to ensure that quantities in this final inventory are the same as the initial inventory and conditions of the spare parts. If spare parts are missing or damaged, the Contractor shall, at their cost, purchase or repair spare parts to bring inventory levels back to the standards recorded at the commencement of this maintenance Contract. WMATA will review any requested exceptions.

For the period of this Contract, the Contractor shall be responsible for maintaining the quantities of parts in inventory. Should WMATA choose not to extend the parts warranty, the Contractor shall supply WMATA with any necessary replacement parts (above those needed to support the Maintenance Program) at the prices submitted on the Contractor's Spare Parts Price Form. If a required part or component is no longer available from a third party supplier to the Contractor, the Contractor shall identify or develop a compatible

replacement solution that retains the overall functionality of the original part or components at a price that is acceptable to WMATA.

8.5 Parts Maintenance

At WMATA's sole discretion, the Contractor shall provide ongoing parts repair and replacement for all non-consumable parts. Parts repair and replacement services shall include:

- Shipping costs to ship failed parts removed from the field;
- Testing/troubleshooting parts submitted for repair;
- Parts repair or replacement;
- Parts tracking and monthly reporting of all repair actions; and
- Bench level testing for parts firm ware updates.

The Contractor deliver a parts management system that maintains an active inventory of all parts that are under the service contract that identifies the location and status parts submitted for repair. The Contractor shall provide monthly reports on the disposition of all parts submitted for repair. CDRL 8-6.

8.6 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CLRL 8-1	Warranty Maintenance Plan	8.2	90 days before deployment	Yes
CDRL 8-2	Spare Parts Catalog	8.2	FDR	No
CDRL 8-3	Spare Parts Recommended Quantities	8.2	FDR	Yes
CDRL 8-4	Spare Parts and Inventory	8.4.1	After 90 day warranty period	Yes
CDRL 8-5	Monthly Software Maintenance Reports	8.4	Monthly after System Acceptance	No
CDRL 8-6	Monthly Parts Maintenance Reports	8.5	Monthly if WMATA exercises Parts Maintenance Option	No

End of Section 8