Washington
Metropolitan
Area
Transit
Authority

Technical Specification

New Electronic Payments Program

RFP Step-2

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WMATA New Electronic Payments Program (NEPP)
Technical Specification

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1 SYSTEM DESCRIPTION

1.1 Overview

The Washington Metropolitan Area Transit Authority (WMATA) plans to modernize and replace its fare collection system and is currently preparing to procure a new electronic payments system in 2011. The New Electronic Payments Program (NEPP) shall be based on centralized accounts with fare calculations being performed by a Central Data System (CDS) rather than by field devices.

More than a decade has passed since WMATA, the first US transit agency to adopt contactless smart card technology, introduced SmarTrip®. The time has come to modernize WMATA`s fare collection system and provide a broader array of payment alternatives to its customers. Expanded payment alternatives shall include providing functionality additional to that available today and the acceptance of multiple forms of smart media. This shall afford customers the opportunity to make fare and parking fee payments through various forms of contactless smart media, including credit and debit media.

While the NEPP represents a key opportunity for WMATA to modernize its legacy fare collection equipment and practices, the primary goal of this project is to significantly enhance customer convenience, experience, and service. However, the NEPP shall also be procured and implemented in a cost-effective manner.

The NEPP shall also provide WMATA a substantially greater degree of flexibility to introduce innovative concepts and features to its patrons. This includes, but is not limited to, the acceptance of new forms of payment, increased variety and types of media that can be processed, improved methods of communication and customer services, and more rapid integration of emerging technologies.

Through the NEPP, WMATA wishes to leverage new market-driven opportunities for fare payments and fare media by interfacing with the financial and wireless industries to accept a variety of contactless, open standard, fare payment media. The NEPP shall be “form-factor agnostic,” accepting all forms of ISO/IEC-14443 compliant media, including, but not limited to:

- Credit card-sized media;
- Key-fobs;

- Watches;
- Mobile phones; and
- Adhesive labels.

This NEPP shall accommodate and process Near Field Communications (NFC) based media (including mobile phones), which are based on an extension of the ISO/IEC-14443 standard. Further, the NEPP shall comply with contactless and EMV (EuroPay, MasterCard, Visa) standards.

The NEPP shall also accept a number of media already common within the WMATA service area, including government-issued contactless identification media compliant with the Personal Identification Verification (PIV) standard. PIV media includes the Common Access Card, as well as numerous other federal government, corporate and school/university-issued media.

For types of media where a payment mechanism is not directly associated with the media, including agency and partner-based media, the physical media shall act as the token for accessing an account maintained within a CDS. Within this account, customers shall be able to link their media with established payment mechanisms enabled by WMATA. This can include, but is not limited to:

- Personal checking or savings accounts;
- Bank-issued contactless credit and debit accounts;
- PayPal accounts;
- Electronic Benefit Transfer (EBT) accounts, including the Federal Transit Benefit Program;
- Any account that is managed or administered in accordance with agency or partner arrangements; and
- Emerging financial and other account types.

The architecture for the NEPP will transition WMATA from a proprietary, single-supplier architecture to an agency-controlled, multi-supplier open architecture, with well-defined interfaces owned and controlled by WMATA.

When completed, WMATA envisions the NEPP as an integrated, electronic fare payment and collection system that incorporates new payment technologies capable of interfacing with both inter-bank and non-bank financial clearing systems for transaction settlement.

WMATA intends to deploy the NEPP across all modes of transportation operated as part of the WMATA system, including Metrorail, Metrobus, barrier-free environments for forthcoming light rail/streetcar service, MetroAccess (paratransit) and to WMATA Regional partners.

For this program, WMATA will employ a Systems Integrator with demonstrated expertise in implementing complex transaction-based systems and integrating the necessary hardware, software and ancillary components from a multitude of third-party suppliers. The Systems Integrator shall develop a system that utilizes an open architecture and WMATA-owned interfaces, allowing for equipment from a range of vendors to communicate with a single common CDS. The CDS shall monitor and control the functionality of all equipment; collect, store and report data; and clear/settle all customer transactions.

The CDS shall utilize a set of Application Programming Interfaces (APIs) that allow multiple vendors to integrate into the NEPP. This shall also include all necessary interfaces to integrate the new system with WMATA legacy systems, including Trapeze and Peoplesoft applications. The Systems Integrator shall develop the necessary APIs for the NEPP and provide them to WMATA. These APIs shall become the property of WMATA for their exclusive and unlimited use. WMATA envisions the use of independent third-party firms to certify the open architecture and completeness of the APIs.

The NEPP will be integrated with WMATA's other Mission Critical Business Systems (PeopleSoft, Trapeze, Maximo), and provide robust reporting and business analytics capabilities, including a "dashboard" capability for executive management. All data that is generated or stored by the CDS shall also become property of WMATA, enabling the Authority to perform comprehensive reporting and reconciliation.

The CDS shall feature a comprehensive risk management approach to identify fraudulent transactions, including possible areas of fare evasion, and other sources of fraud. This shall enable WMATA to make well-informed business decisions regarding transaction processing fees, settlement frequency, and loss mitigation.

New features shall be incorporated to enable enhanced customer service, convenience, and usability. Upgrades and improvements shall address automated customer service channels such as Fare Vending Devices (FVDs), Web Services, Interactive Voice Response (IVR) systems, and automatic account reloads. These features shall provide customers with more convenient ways to obtain and reload smart media. In addition, new system applications shall allow WMATA to offer registered customers desirable new services including expanded web-based account management and transaction tracking.

The NEPP shall be scalable, to allow for future adaptation and additions by WMATA. For example, the addition of the new Dulles airport extension and infill stations shall be easily incorporated into the system.

The NEPP shall remain adaptive and responsive to customers' changing needs. The system shall be capable of easily being configured to accept new forms of payment, and interacting with emerging new consumer electronics devices.

Prior to implementation, WMATA and the Systems Integrator will solicit program input from all internal and external stakeholders. This shall provide customers with an opportunity to express their concerns and gather valuable stakeholder input regarding the project. It shall also serve to solicit input regarding equipment and applications. Pre-implementation customer input will be essential to a successful system deployment.

1.1.1 Fare Structure

The NEPP shall be capable of accommodating the existing and future WMATA fare structures and business rules, as well as the business rules and fare structures used by the WMATA Regional Partners. The NEPP shall also properly process Federal transit benefits. As a minimum, the system shall accommodate fares, which may vary by:

- Rail station entry/exit location;
- Bus boarding location;
- Time of day;
- Day of week;
- Distance traveled;

- Zones traveled;
- Individual user (affinity benefits);
- User category (seniors, employees);
- Mode transferred to/from;
- Specially designated days (holidays);
- Variable parking fees by location and date;
- Special services (express buses).

The NEPP shall accommodate all types of fare products available on current WMATA and Regional Partner systems. WMATA shall be able to modify the system to accept a different fare structure without Contractor assistance. This ability shall include the flexibility for WMATA to change fares for individual stations and routes, and throughout the system, including parking on a scheduled or ad-hoc basis. Fare calculations shall be made by the CDS and when necessary, shall be completed before transmittal of payment information to the field device.

Additionally, the system shall accommodate all fare rules required to support MetroAccess.

The system shall support employer subsidies and pretax benefits for parking fee and fare payment. For these subsidies and benefits, payment shall not be deducted from the customer's personal store of funds until the pretax amount is depleted. Partial payment with pretax benefits shall also be permitted. The system shall comply with the Internal Revenue Service (IRS) revenue ruling 2006-57 regarding the separation of transit benefits and parking benefits, and all other regulations that may be put into effect during the implementation of the System. A variety of WMATA-issued and third-party issued media, including PIV credentials, shall be usable by customers accessing such accounts.

1.1.2 Existing AFC System

WMATA currently operates an electronic Automated Fare Collection (AFC) system based on Cubic Transportation Systems (CTS) Nextfare® 5 software and hardware platform. This system incorporates faregates, fare vending devices, and other pieces of equipment that process both magnetic and contactless media.

The contactless media in use today utilizes CTS proprietary GoCard® format. Prior to implementation of the NEPP, WMATA will have undertaken an initiative to begin migrating the SmarTrip® product from this proprietary format to an ISO/IEC-14443 compliant media. While this effort will transition the SmarTrip® product to an open standards platform, customer account information will remain encoded on the card, and fare calculations will continue to be performed via fare tables stored locally within each field device.

1.2 Overview of WMATA Operations

The Washington Metropolitan Area Transit Authority (WMATA) was created by an interstate compact in 1967 to plan, develop, build, finance, and operate a balanced regional transportation system in the national capital area. WMATA began building its rail system in 1969, acquired four regional bus systems in 1973, and began operating the first phase of Metrorail in 1976. Today, Metrorail serves 86 stations and has over 106 miles of track. Metrobus serves the nation's capital with approximately 1,500 buses. Metrorail and Metrobus serve a population of 3.4 million within a 1,500-square mile jurisdiction.

1.2.1 Service Region

WMATA’s transit zone consists of the District of Columbia, the suburban Maryland counties of Montgomery and Prince George’s and the Northern Virginia counties of Arlington and Fairfax, and the cities of Alexandria, Fairfax and Falls Church.

With the extension of Metrorail service to Dulles airport, the region will expand to include service into Loudoun County, Virginia.

1.2.2 Metrobus

Metrobus operates bus service on 320 routes on 135 lines throughout the WMATA region utilizing 12,000 bus stops. Currently, the fleet comprises 1,480 buses of varying sizes and capacities.

In Fiscal Year 2011, approximately 127.6 million trips are expected to be taken on Metrobus. This is an average of 440,000 weekday trips. In FY 2009, there were a total of 134 million trips on Metrobus. Bus ridership is projected to expand to 510,000 average weekday trips by 2020, or about 1% a year growth.

1.2.3 Metrorail

The Metrorail system is a rapid transit system that consists of 106.3 route miles and 86 passenger stations and a fleet of more than 1,100 rail cars. In Fiscal Year 2011, Metrorail is expected to provide more than 219 million passenger trips. The system comprises three main types of structures: subway, surface and aerial. The subway (or underground) sections consist of 50.5 route miles and 47 stations. The surface sections comprise 46.31 miles and 33 stations, and the aerial sections consist of 9.22 route miles and 6 stations.

On an average weekday in FY 2009 there were about 750,000 trips on Metrorail. Overall growth between 2009 and 2020 is estimated at about 20% to 910,000 average weekday trips. By 2030, Metrorail ridership is expected to be close to 1 million trips a day.

1.2.4 MetroAccess

MetroAccess is a shared-ride, door-to-door paratransit service for people whose disability prevents them from using bus or rail. The MetroAccess system operates a fleet of over 600 vans and sedans and is expected to provide approximately 2.7 million passenger trips in Fiscal Year 2011.

By 2020, ridership on MetroAccess is anticipated to grow to 4.5 million trips (a 112% increase).

1.3 Regional Partners

WMATA also interfaces with non-WMATA transit systems, for both bus and rail services. Many of these transit systems, utilize the SmarTrip® platform to allow for use of the media throughout the region. These agencies that share the SmarTrip® platform are WMATA Regional Partners.

These Regional Partners include the following:

- Van Pools – from the District as well as the surrounding states, which use SmarTrip® and SmartBenefits.

- Virginia Railway Express (VRE) – a commuter rail service from Northern Virginia to Washington, D.C. which employs a paper-based proof-of-payment system

- Regional Buses – various area bus systems which presently utilize the SmarTrip® for fare payment and/or verification, including:
    - ART – Arlington Transit
    - CUE – Fairfax City
    - DASH – Alexandria Transit Company
    - Fairfax Connector
    - Loudoun County Commuter Bus Service
    - Maryland Mass Transit Administration including
        - MARC – commuter rail service from central/northern Maryland to Washington, DC which employs a zone-based fare, and on-board proof-of-payment
        - Metro – subway system in the Baltimore area which employs a flat fare, gated system.
        - Light Rail – light rail system in the Baltimore area which employs a flat fare, proof-of-payment system
    - MCRO – Montgomery County Transit Ride-On
    - PRTC – Potomac and Rappahannock Transportation Commission
    - The Bus – Prince Georges County DOT
    - Washington DC Circulator.

Each of these transit services permits the use of the WMATA SmarTrip® and CharmCard® for fare payment.

This Section outlines many of the initial requirements of the NEPP for WMATA, including field equipment and the CDS. However, regardless of field equipment that is procured, the CDS as configured must be able to accept data from all regional partners.

1.4 New Electronic Payments Program

The NEPP shall not serve to immediately replace the existing AFC system in its entirety. Particular elements of the existing AFC system will be retained and leveraged by WMATA to the best extent possible. To support this, the existing AFC back-end systems will remain operational as needed to ensure continual operation. However, the NEPP must provide a methodology and functionality that shall allow legacy and new system elements to coexist and appear as one seamless system to both customers and WMATA.

All WMATA passengers shall transition to the NEPP and all fare validity shall be stored at and authorized by the CDS on a real time basis. Ideally, the existing customers shall be automatically converted from SmarTrip® to NEPP fare media processing methodology without manual intervention.

WMATA intends to operate a modern fare collection system that incorporates open payment methods using multiple technologies in an open architecture. The system shall utilize APIs developed for, and controlled by, WMATA. These APIs must be comprehensive and be allow for equipment from multiple suppliers.

APIs must include the detailed definition of the interfaces between devices and the CDS, including fare payment and usage messages as well as device control and event messages. The Contractor shall be responsible for ongoing updates of APIs and provide a program for certifying any equipment supplied by third parties for use by the NEPP.

The NEPP shall address WMATA's Fare Policy Principles, as recently adopted by WMATA's Board on November 18, 2010 under resolution 2010-66, which are to:

- Ensure and enhance customer satisfaction;
- Establish a mechanism to allow customers to determine their fare easily;
- Optimize the use of existing capacity;
- Establish equitable fares and ensure compliance with federal regulations;
- Facilitate movement between modes and operators throughout the region;

- Encourage the use of cost-effective media; and
- Generate adequate revenue while maximizing ridership.

To support these needs, WMATA's strategic business interests with regard to the NEPP are to:

- Provide current and potential WMATA customers with a modern system that utilizes convenient, secure fare media and payment options that improve customer service;
- Provide WMATA with a cohesive system that can integrate fare collection equipment and software from multiple suppliers, including those selected by WMATA, and allow for future expansion;
- Permit emerging payment methods and various media form factors to be utilized without need for system modification;
- Permit any ISO/IEC 14443-based media that is linked to a financial institution or other payment source (e.g., credit and debit media) to be used as valid payment media in a “Pay-As-You-Go” environment;
- Permit any ISO/IEC 14443-based device to be used as valid media if linked to a central account, rather than requiring all passengers to carry WMATA-issued fare media;
- Maintain the existing AFC backend systems and leverage existing field components, as part of a new system that is seamless to customers;
- Provide enhanced data and information for planning and other purposes;
- Provide continued operation of the SmarTrip® product and functionality, and provide a phased transition to a new system in the future;
- Increase operating efficiencies and system flexibility; and
- Provide transit services with enhanced revenue security and accountability.

Successful implementation of the NEPP will provide WMATA with the opportunity to update the present fare collection equipment and methodology and to enhance the existing level of customer service. This shall include the ability to offer fare plans tailored to changing customer needs and travel patterns, as well as providing ”personalized” fares.

The entire NEPP system including all hardware, software and communications, shall be fully compliant with Payment Card Industry (PCI) security standards and, to the extent possible, minimize PCI scope and ongoing operating compliance costs.

1.4.1 Major System Goals for the NEPP

WMATA’s major goal for external stakeholders is to provide an electronic fare payment system that:

- Is convenient and usable by current and potential customers;
- Provides customers with modern and convenient fare payment options across all transit modes;
- Facilitates and promotes customer self-service;
- Is secure and reliable;
- Is easy to understand;
- Provides continued use of SmarTrip® media;
- Facilitates seamless customer transfer among adjoining transit agencies at connection points, regardless of whether the adjoining agency has migrated to NEPP.

WMATA’s major system goal for internal stakeholders is to provide an electronic fare payment system that:

- Is secure and reliable;
- Introduces enhanced fraud and risk mitigation mechanisms;
- Provides accurate revenue reporting management and accountability;
- Provides accurate and timely ridership and revenue data;
- Reduces cash handling by WMATA staff;

- Fosters fare policy innovation and tailoring;
- Eliminates WMATA's dependency on a single supplier for compatible fare collection equipment;
- Eliminates WMATA's role as the sole transit-specific fare media issuer;
- Leverages market-driven capabilities to reduce WMATA's role as transaction acquirer and processor;
- Balances all other goals in the most cost effective manner available.

1.4.2 Major System Constraints for the NEPP

The major constraints that must be considered during system design relate to the infrastructure of WMATA systems.

1.4.2.1 Existing System

Today, WMATA utilizes an automated fare collection system developed primarily by Cubic Transportation Systems (CTS) (Figure 1-1).

When first deployed, the NEPP and the legacy system shall be in operation concurrently.

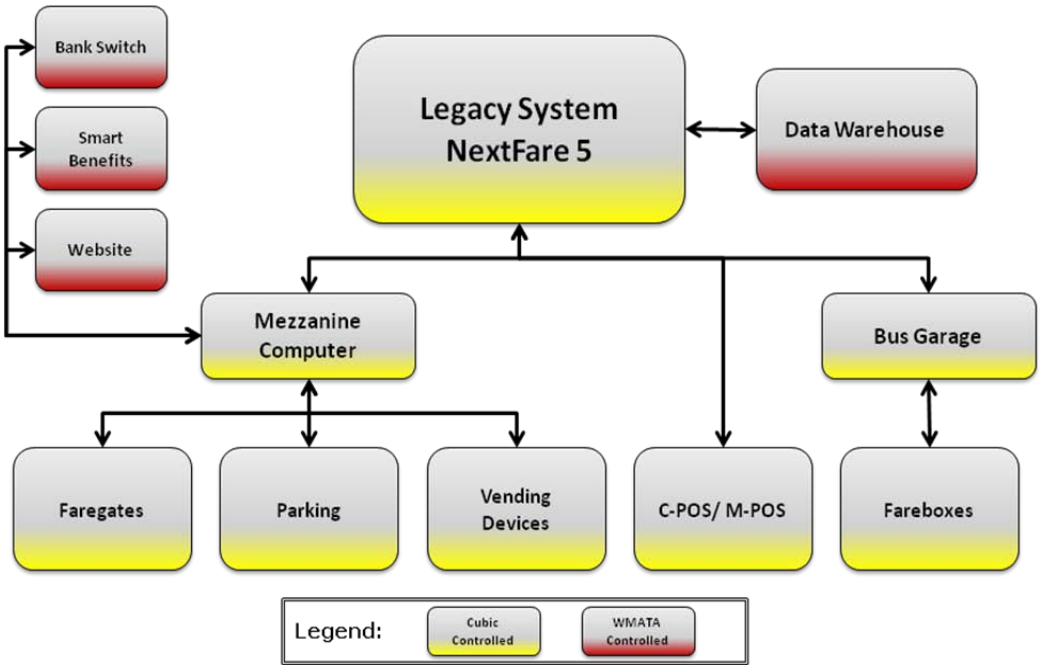

Figure 1-1 – Existing Fare Collection System

The NEPP shall be integrated with WMATA business systems to provide a logical system for fare collection that shall accept and process existing fare media and new smart media.

1.4.2.2 The NEPP shall draw information from the legacy Data Warehouse to provide seamless reporting capability. Existing Conditions

The NEPP shall interface with WMATA's existing infrastructure, specifically:

- physical conditions at stations and their associated parking facilities;
- existing communications and data network;
- location, size and equipment of facilities that support and maintain the existing fare system;

The NEPP must interface as required with the existing data warehouse to provide timely and accurate reporting for ridership, revenue, and maintenance.

1.4.2.3 New Projects and Conditions

The NEPP shall be designed and deployed within an ongoing program of improvement projects within WMATA. Several projects currently underway or planned will affect the NEPP and must be considered in the design. These include deployment of a new computer aided dispatch and automated vehicle location (CAD/AVL) and related on-board systems on the bus fleet, the Dulles Airport Metrorail extension, communication system upgrades, information technology improvements, and changes to business processes.

1.4.3 Envisioned NEPP

The functionality and equipment provided by the NEPP shall support all modes of transit and the needs of all categories of customers.

1.4.3.1 Fare Payment Media

The primary fare payment media on all modes of the system shall be ISO/IEC 14443 compliant contactless smart media or limited use media.

To accommodate WMATA's existing customer base and to ease the transition into the new system, the NEPP shall enable customers to choose among the following fare media for payment on WMATA's transportation modes:

- Bank issued smart media (stored value or credit/debit media) and other form factors such as RFID microchip equipped key fobs;
- Mobile phones equipped with Near Field Communications (NFC);
- Media compliant with the PIV standard, including the CAC;
- Contactless government issued media compliant with ISO/IEC 14443 Standards;
- Contactless Limited Use Media (LUM), compliant with relevant ISO/IEC 14443 standards, to replace magnetic media;
- Third party-issued long-term ISO/IEC 14443 media;
- Market driven payment technologies and media complying with ISO/IEC 14443 Standards;

- WMATA-issued, account-based, long term smart media, using SmarTrip® or new branding;
- US Currency (bill and coin).

WMATA Smart Media shall be able to be used for all WMATA fare products, including reduced-fares, and shall be able to be linked through a customer-managed WMATA account to an external payment account, such as a credit/debit, checking, or PayPal. Account linking shall enable a variety of account management options including, but not limited to:

- Automatic replenishment of an account with stored value;
- Threshold-based renewal of time-based credentials;
- Parking and transit services (with separate thresholds in the same account for parking versus transit usage);

To optimize system utilization and address the needs of infrequent riders, WMATA must have the option to dispense media to customers without smart media. To support this, the NEPP shall facilitate the deployment of limited use media (LUM) for low value, short-term products such as single trip tickets or day passes. LUM shall be account-based media, similar to the other media accepted by the NEPP.

Magnetic fare media shall not be issued or processed by the NEPP.

1.4.4 Media Distribution and Reload Strategy

Sales and reload channels for WMATA-issued smart media and limited use media shall include existing WMATA-operated sales offices, sales partners, and automated systems. Customers shall be able to purchase and reload smart media and limited use media accounts through both in- and out-of-station FVDs and at retail sales locations. In addition, they shall be able to order and reload WMATA-issued smart media through web and mobile services and a designated call center. Customers shall also be able to activate and modify automatic reload services through these and other channels.

1.4.5 Mobile and Web Applications

Mobile and web applications shall provide a convenient, comprehensive ability for WMATA customers to purchase fare products and perform other self-service tasks, and shall be integrated with existing WMATA websites to provide for "single account" functionality. Mobile applications shall also use NFC capabilities to enable fare payments at NEPP devices and allow for over-the-air provisioning of WMATA Smart Media to mobile devices.

1.4.6 Operating Scenarios

The operating scenarios included within this specification describe the NEPP and its operations as currently envisioned by WMATA.

For each operating scenario, the Contractor shall provide a detailed explanation of how information will be collected to support all operational and reporting needs for WMATA revenue, ridership, and maintenance. Additionally, the Contractor shall be responsible for the integration of data (ongoing) from the existing fare payment systems to create a single comprehensive system that provides for timely and accurate financial and system reporting.

In addition to the operational scenarios below, inter-agency and inter-service discounts and transfers shall be provided.

1.4.6.1 Metrorail

In the Metrorail environment, new faregates or turnstiles shall continue to provide a barrier to mezzanine entry and exit until a passenger presents valid fare media. The faregates shall feature consoles with Payment Processing Targets (PPTs) for processing electronic fare payments. Magnetic fare media will no longer be issued by WMATA or accepted at faregates after full transition to the NEPP.

Faregates shall be designed and configured to be ergonomically acceptable and to allow the greatest number of passengers to pass through from either direction. Customer-friendly Fare Vending Devices (FVDs) shall be installed within the free area(s) in all stations to add value/passes to WMATA smart media accounts, and to dispense media that shall allow customers without smart media or credit/debit media to pass through the faregate barriers. Within the paid area, FVDs shall also be installed to permit additional payment for exit to the free area(s) of a station.

FVDs shall be capable of providing a single point of interaction for Metrorail customers using both SmarTrip and NEPP Smart Media.

To support the deployment of equipment on each Metrorail mezzanine, the NEPP shall utilize the WMATA MetroNet to carry network communications. The WMATA MetroNet utilizes a fiber optic backbone to each Metrorail station mezzanine that is controlled and operated by WMATA.

At each mezzanine, all equipment shall be connected utilizing WMATA supplied power and communications cabling.

FVDs and faregates shall transmit transaction information to the CDS utilizing the WMATA MetroNet network.

The NEPP equipment necessary to support the Metrorail operating scenarios includes:

- Fare Vending Devices;
- New Faregates or turnstiles;
- Wired communications infrastructure;
- Station manager equipment at kiosks.

To meet the present operational methodology when using NEPP to pay a fare on Metrorail, the customer will present the media to a PPT located on an entry gate. Enough information shall be collected to determine credential and account validity to charge the appropriate fare and satisfy applicable business rules. A command shall be transmitted to the faregate barriers to open that shall allow the customer to pass through the aisle into the Metrorail station.

Upon exit, the customer will be required to present the same media used at entry to a PPT located on an exit gate. The NEPP shall collect sufficient information to calculate the fare due. As part of the fare calculation, credit for transferring from a bus or from a recent rail trip may be applied, complying with WMATA business rules. The NEPP shall process the transaction, send a response to the exit gate and a command shall be issued to open the barrier.

The operation of the faregates shall be capable of providing controlled entry and exit, subject to WMATA fare policy.

Fare calculations shall be computed when all data required tocalculate the fare is received. In the event that a device loses communications connectivity, the NEPP Contractor shall implement a method to process smart media, retain all necessary data for reporting and reconciliation, and assure the collection of revenue.

In the event that communications are unavailable when a customer is leaving the system through a fare gate, the system shall not inhibit the departure from the station. In this configuration, the faregate shall bank all exiting transactions for transmittal to the CDS when communications are restored.

All efforts shall be made to improve throughput of fare arrays to the extent possible.

Within the station environment, Station Managers shall be provided with information to facilitate customer service. When presented with media, Station Managers shall be able to utilize the Administrative Customer Service Application (Section 5) to access basic account information including balance, period pass validity, current mode (enter/exit), reason for most recent rejection, and if the account is hot listed. Station Managers shall also be able to utilize the System Status Application (Section 5) to view a status monitor that shall provide the status of all equipment located in the mezzanine from a central location.

1.4.6.2 Metrobus

Today, all Metrobus vehicles are equipped with validating fareboxes. These fareboxes include the necessary hardware and software to process SmarTrip® media. The NEPP project will not affect the existing fareboxes. To support the NEPP, all Metrobus vehicles shall be augmented with a new Payment Processing Target (PPT) to process NEPP smart media.

An On-Board Processor Target (OBPT) shall be deployed along side the farebox to process smart media transactions using all forms of accepted and enabled payment media. The OBPT shall transmit transaction information to the CDS over a wireless connection.

A farebox overhaul is scheduled to be performed starting in Fiscal Year 2012. The work associated with that overhaul is outside the scope of this program.

Equipment needed to support the Metrobus operating scenarios are as follows:

- Stand-alone On-Board Processors (OBPTs);
- OBPT wireless communications capability.

When using the system to pay the fare on Metrobus, the customer will present the media to the OBPT. The OBPT shall send the appropriate information as well as date/time and location to the CDS where the fare shall be calculated, the transaction processed, and a response sent to the OBPTOBPT. This communication shall be real time and shall use the communications infrastructure installed as part of the CAD/AVL upgrade. For Regional Partners, new communications infrastructure shall be provided as a part of the NEPP.

Audio and visual feedback shall be provided to the customer and bus operator indicating whether or not the media was accepted for fare payment. The fare calculation, performed automatically at the CDS, shall also determine the appropriate credit for a customer transferring from another bus or rail, consistent with WMATA fare policy.

Data integration with various on-board bus and other business systems shall be implemented to facilitate timely, accurate, and comprehensive alert reporting of vehicles that may be processing in orphan mode for an excessive period of time or otherwise be out of communications with the NEPP.

In addition to the above, off-board fare collection equipment primarily envisioned for Commuter Rail, Light Rail and Streetcars (such as Handheld Sales Devices and Platform Validators) shall be capable of being implemented for use in an off-board bus fare collection environment, such as Bus Rapid Transit (BRT).

1.4.6.3 MetroAccess

MetroAccess is a shared-ride, door-to-door, paratransit service for people whose disability prevents them from using bus or rail. Additionally, MetroAccess customers who are conditionally eligible may travel aboard Metrobus or Metrorail, and various regional partners, free of charge.

For MetroAccess customers that utilize the system to connect with fixed route services, they shall be able to process their media through OBPTs, Faregates, or other devices associated with the NEPP, consistent with that for any other customer. Customers connecting from MetroAccess to fixed route service shall be able to utilize the fare payment equipment at any location or vehicle, without special attention by an operator or Station Manager. Customer shall also be able to access the same external reload network as other customers.

MetroAccess customers shall be provided with ISO/IEC-14443 compliant media that shall have the capability to include a photo and other necessary identification of the registered customer, and shall serve as MetroAccess identification. The NEPP shall be capable of accepting photo IDs issued outside of the NEPP, whether by WMATA or other third-party organizations, and having such media linked to NEPP accounts. Initially It is envisioned that MetroAccess customers eligible to ride on fixed route services will be the first customer group to obtain new fare media.

To support this operation, the CDS shall be capable of processing linked transactions as defined by customer specific needs. The CDS shall process a fare payment according to the proper rules and shall allow for an accompanying companion. This includes allowing the appropriate, registered, customers to independently ride Metrorail and Metrobus via the WMATA Board Approved Free Ride program.

Currently, MetroAccess customers have the option of paying for transit through an EZ-Pay program. This program provides a customer the ability to pre-pay for services utilizing credit and debit accounts as well as SmartBenefits.

MetroAccess utilizes a third-party application to support its EZPay System and the NEPP shall interface with EZ-Pay to enable NEPP accepted smart media to be utilized as to access MetroAccess EZ-Pay accounts for replenishment of accounts and trip bookings, and for the payment of MetroAccess fares. The NEPP shall update MetroAccess' existing Trapeze PASS system and allow for updates to be sent by Trapeze PASS.

In the future, Handheld Sale Devices (HSDs) may be deployed to MetroAccess operators to accomplish smart media transactions. If deployed for MetroAccess, the HSD shall process all forms of accepted and enabled smart media and transaction information shall be transmitted to the CDS by a wireless connection.

The NEPP equipment needed to support potential future MetroAccess operations include:

- Handheld Sales Devices (HSDs);
- HSD wireless communications capability.

There shall be no equipment permanently installed into a MetroAccess vehicle in this mode of operation. HSDs may be deployed on both dedicated and non-dedicated paratransit vehicles.

When using the system to pay the fare on MetroAccess, the customer will present the media to the HSD. Once the necessary ridership information has been received, the HSD shall send the appropriate information as well as date/time and location to the CDS where the appropriate fare shall be calculated and deducted from the customer's account, including the customer's EZ-Pay account where applicable. Payment shall then be transferred to WMATA.

The HSD shall provide audio and visual feedback to the customer and MetroAccess Operator that sufficient data has been collected to determine the appropriate fare to be charged, and whether or not the media was accepted for fare payment.

For instances where customers ride fixed route services and then connect to MetroAccess, the CDS shall be capable of initiating the entire trip and notifying the MetroAccess operator through the HSD accordingly.

1.4.6.4 Parking

Payment lanes shall incorporate a new Payment Lane Processor (PLP) that interfaces with the vehicle detection system and parking gate as well as the parking software installed at the Parking Operations Center. The NEPP System shall provide for parking processing and fee payment in a manner similar to the existing methodology.

Gated Parking Lots

In the gated parking lots, customers currently pay for parking utilizing their SmarTrip® media. In addition, a customer may pay for parking using magnetic credit/debit media at a limited number of stations. The acceptance of magnetic credit/debit media will be expanded to all lots prior to deployment of the New Electronic Payments Program (NEPP) and will be retained.

With the deployment of the NEPP, customers shall be presented with the opportunity to pay for parking in a variety of new ways. Customers shall be able to pay for parking at gate locations utilizing a variety of contactless media.

Customers shall have the ability to link parking to their account, and be able to purchase period based parking privileges.

The parking payment equipment needed to support the parking payment scenarios includes only a new Payment Processing Target, which shall replace the SmarTrip® target and shall be interfaced with the other existing parking system components.

A customer will present their media to the PPT located on the parking facility booth or post adjacent to their travel lane. The PPT shall transmit the transaction data to the CDS, which shall capture the appropriate information, calculate the appropriate parking fee, and deduct that amount from the customer account. Audio and visual feedback shall be provided to the customer indicating whether the media was accepted for payment.

The parking facilities shall be capable of being configured to charge hourly, daily, and extended stay parking rates. Additionally, WMATA shall be capable of charging transit and non-transit parking rates. In this scenario, customers who utilize Metrorail in conjunction with parking shall be charged a transit parking rate, and others shall be charged a non-transit rate. Currently, this is determined by the use of their SmarTrip® card within a specified time period from when that same media is tagged at the parking facility.

Customers who do not tag the same payment media (used to enter the parking facility) on a Metrorail NEPP device are assumed not to have used the transit system and shall be charged a higher, non-transit related parking fee. The NEPP shall accommodate this requirement, allow for different non-transit related parking fees at different lots, and allow WMATA to change the parameters and fees.

In addition, the NEPP shall provide WMATA the ability to deploy some or all of these rate categories, and to specify different values for each category on a per facility basis. Rates for parking lots shall be easily configurable and not require re-coding or programming of the system or components.

Depending on the policies and configuration of the facility, NEPP shall support collection of the parking fee on entry to the facility or on exit from the facility.

Pay By Space Lots

WMATA also operates several pay by space parking lots. Currently, WMATA is deploying new meter heads for these lots that must remain in place for enforcement purposes. Additionally, WMATA is undertaking a meter-based online/cell phone payment pilot project to test payment for parking via mobile and web based applications.

This online and mobile functionality for payment of parking shall be provided system wide utilizing the parking payment applications outlined in Section 5.

1.4.6.5 Light Rail

The District of Columbia is in the process of constructing a new light rail system through the District. Additionally a second streetcar/light rail system is planned to be implemented by Arlington County and Fairfax County. There are also other similar initiatives in the area that will are envisioned to be coordinated regionally and may utilize a common framework for fare payments.

In the Light Rail environment, WMATA envisions that the customers' primary interface with the NEPP to be through FVDs and Platform Validators (PVs).

FVDs shall be installed in stations to add value/passes to WMATA smart media accounts, and to dispense media which customers shall subsequently present on-board as an acceptable proof of fare payment.

In addition to FVDs, it is envisioned that the stations shall feature PVs. When using the NEPP to pay a fare on the Light Rail System, the customer will present media to the PV at a station prior to boarding the vehicle. The PV shall send the appropriate information as well as date/time and location to the CDS where the fare would be calculated and deducted from the customer's account and payment transferred to WMATA.

In addition to PVs and FVDs, a means or mechanism shall be available onboard a Light Rail vehicle to validate that a customer has paid their fare. It is envisioned that a Handheld Sales Device (HSD) shall be used to read and validate fare payment using smart media or LUM. An HSD shall also have the option of decrementing the appropriate fare from an account, charging a credit/debit media or other enabled forms of fare payment and encoding a LUM as a Cash Fare Receipt and ticket.

The NEPP equipment needed to support Light Rail operations are as follows:

- Handheld Sales Devices (HSDs);
- Stand-alone Platform Validators (PVs);
- Fare Vending Devices (FVDs);
- HSD, PV, and FVD wireless communications capability.

All communications to the station locations as well as the HSDs on the Light Rail system shall occur in real time via a commercial wireless provider. This shall serve to transmit all transaction information to the CDS.

For the PV and HSD, when presented with a piece of contactless smart media, both visual and audio indications regarding media validity shall be provided. If a piece of media is rejected, basic information, including (but not limited to) “insufficient funds”, “invalid media”, and “media hot listed” shall be provided.

Vehicle-based vending devices may also be used for on-board sales. It is envisioned that these devices may accept only cash and dispense printed media/tickets. These devices are not part of this specification and will be procured outside of the NEPP, but the NEPP shall provide an API for sales, reconciliation and other data to be loaded to the CDS for consolidated reporting. For on-board validation, NEPP OBPTs may be utilized if required.

1.4.6.6 Streetcar

For streetcar applications, vehicle based-sales and validation devices shall permit customers to pay fares after boarding a vehicle. On-board equipment shall send the appropriate information as well as date/time and location to the CDS where the fare would be calculated and deducted from the customer’s account and payment transferred to WMATA.

The NEPP equipment needed to support streetcar operations are as follows:

- Handheld Sales Devices (HSDs);
- HSD and VVVD wireless communications capability.

All communications with the HSDs on the streetcars shall occur in real time via a commercial wireless provider. This shall serve to transmit all transaction information to the CDS.

For the HSD, when presented with a piece of contactless smart media, both visual and audio indications regarding media validity shall be provided. If a piece of media is rejected, basic information, including (but not limited to) “insufficient funds”, “invalid media”, and “media hot listed” shall be provided.

Vehicle-based vending devices may also be used for on-board sales. It is envisioned that these devices may accept only cash and dispense printed media/tickets. These devices are not part of this specification and will be procured outside of the NEPP, but the NEPP shall provide an API for sales, reconciliation and other data to be loaded to the CDS for consolidated reporting. For on-board validation, NEPP OBPTs may be utilized if required.

1.4.6.7 Regional Partner Operations

In addition to WMATA, the NEPP shall support WMATA Regional Partners that wish to migrate to NEPP.

Operations at some Regional Partners are similar to those outlined above, including most notably bus operations. However, other Regional Partners operate several modes of service that are not currently in operation at WMATA. This includes Commuter Rail, Bus Rapid Transit (BRT), and Express Bus Services.

To support these services and future growth, the NEPP shall be capable of being adapted and expanded. This shall include the ability to deploy fixed location equipment, such as FVDs and PVs, at locations along service routes. Additionally, for proof-of-payment environments such as Commuter Rail, mobile applications shall accommodate fare ticketing/payment in a manner that can accommodate visual inspection by agency personnel so as not to hinder operational efficiency.

In addition, the NEPP System, for proof-of-payment and barrier-free environments, shall accommodate different forms of fare collection and enforcement. The NEPP System shall be capable of supporting on-board vehicle sales and proof-of-payment enforcement via the handheld wireless device (HSD).

1.4.6.8 Central Data System

To support the NEPP System, the entire system shall be controlled and monitored from a Central Data Collection System (CDS). This CDS shall be the single data repository and control location for all NEPP equipment provided as part of this system. The CDS shall be designed to interface with the segments of the NEPP data network, to provide a single integrated set of controls and applications for the entire NEPP System. This system shall serve as the central system through which WMATA personnel will monitor and control all aspects of the NEPP System. The CDS shall interface with the WMATA legacy systems identified herein.

1.4.6.9 Media Issuance

The NEPP System shall provide Customers with numerous options for the purchase of WMATA Smart Media. Furthermore, customers shall have the option of accessing a Customer Support Center via the telephone, or utilizing a NEPP E-Commerce website or mobile application. The E-Commerce website shall permit WMATA customers and WMATA Transit Benefit Employers to establish accounts, acquire and register WMATA Smart Media, add value and period passes to employee accounts, review media usage and status, as well as perform Autoload and other replenishment transactions. Mobile applications shall provide similar functions.

The NEPP System shall also permit establishment of WMATA-preferred Vendor accounts. WMATA-preferred vendors shall have the ability to issue WMATA Smart Media and to reload value and/or pass products to WMATA Smart Media accounts by use of an Internet utility, and also by use the Vendor's existing point-of-sale register.

1.4.6.10 Business Reporting and Analytics

A backbone of the new system will be a robust data warehouse with comprehensive business reporting and analytics capabilities. The warehouse will store all relevant usage, payment and equipment tracking/maintenance data for WMATA use. A commercially available package is envisioned, with easy-to-use self-service tools for WMATA users in addition to additional tools for administrative and "power" users. The solution shall be fast, cost effective to administer, easily configurable, user friendly, and based on open architecture principles.

1.4.6.11 Support Services

WMATA is interested in exploring innovative ways to reduce WMATA's current cost of collecting Customer fares. As such, WMATA is seeking creative solutions for efficiencies and operational streamlining throughout the Customer payment model, and other means whereby WMATA can reduce its operating costs, reduce in-house servicing and maintenance requirements, and offer "best value" both internally at WMATA and to its Customers.

As such, the NEPP provides for a series of base and optional Contractor-provided premier support services for WMATA and Regional Partners, including:

- Maintenance Services:
    - Preventive Maintenance;
    - Corrective Maintenance;
- Revenue Servicing;
- Extended Software Systems Support;
- Management of Benefits Programs;
- Smart Media Procurement;
- NEPP Network Administration Services;
- Bankcard Processing Services;
- NEPP Data Operations Services;
- Commercial Wireless Services.

Additionally, the NEPP provides WMATA with the option to run the Customer Support Center.

The requirements associated with the above services are defined in Sections 15, 16, 22 and 23 of this Technical Specification.

1.5 Transition

Contractor shall define and prepare a transition plan to move from the present SmarTrip® system to the new NEPP System. This plan shall incorporate WMATA and all of the Regional Partners and be based on the implementation needs identified in these technical requirements. **CDRL 1-1**

Contractor shall provide the initial transition plan for review by WMATA and the Regional Partners at the Conceptual Design Review, with the appropriate update at the Preliminary Design Review and the final transition plan at the Final Design Review, for approval by WMATA and the Regional Partners.

The Contractor shall adhere to the following guidelines in their proposed transition plan:

- The deployment, installation and testing requirements as identified in Section 19 shall be maintained at all times throughout the transition;
- From commencement to completion of the transition, at all times SmarTrip® and some version of NEPP fare media shall be usable for entry and exit at all Metrorail stations;
- Transition shall include installation and verification of operation of the NEPP in a limited manner as a first step:
    - All NEPP functionality need not be ready to commence operational verification but shall be ready before commencing additional installation effort;
    - The initial operational segment for the Dulles Corridor Metrorail Project shall be included in the operational verification. The majority of the equipment installed shall be for the NEPP, but WMATA will provide the necessary SmarTrip® equipment for the Contractor's use at these stations;
    - A minimum of one bus route which intersects with the initial operational segment for the Dulles Corridor Metrorail Project shall be included and have the required equipment and systems installed;

- Existing equipment may be removed from an existing Metrorail station to a Dulles Corridor Metrorail station; and

- Temporary installation of NEPP equipment at existing Metrorail stations and other locations shall meet all safety, ADA and other applicable regulations to ensure safe and proper operation. This shall include the restriction on surface-mounted conduit and other similar elements.

- The duration of this transition shall not exceed the timeframes as identified in Section 19. It is envisioned that the implementation on the Metrobus fleet transition will be accomplished in a twenty-four (24) month period or less while the Metrorail implementation will require a longer timeframe to complete full transition.

1.6 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 1-1	Provide a transition plan to move from the present SmarTrip® system to the new NEPP System.	1.5	CDR, PDR, FDR	Yes

End of Section 1

Section 2 – General Requirements
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2 GENERAL REQUIREMENTS

These Technical Specifications define the requirements for the design, manufacture, fabrication, furnishing, assembly, testing, inspection, and installation of the New Electronic Payments Program (NEPP) System for Washington Metropolitan Area Transit Authority (WMATA).

The NEPP System will fully outfit WMATA with a complete fare vending and collection system for Customer payments for all WMATA- and Regional Agency-provided transportation services as well as selected other functionalities as defined within these Technical Specifications. This section provides the general requirements for the entire NEPP System.

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.

2.1 General Requirements

The Contractor shall deliver the NEPP System for WMATA and its Regional Agencies to deploy across all modes of transportation. The NEPP System shall be able to process payments based on processing the media, as defined in Sections 3 and 4, without need for hardware or software modification.

All NEPP transactional data shall be stored in the WMATA Data Warehouse. All data input into the NEPP System and all data generated, processed and/or recorded by the NEPP System shall be the property of WMATA and the associated Regional Agencies. All rights are retained to this data and neither the Contractor, nor any agent of the Contractor shall have authority to use, modify, distribute or in any other way utilize this data without the express written consent of WMATA or the appropriate Regional Agency. Even when consent for use of the data is provided, the ownership of the data shall remain with WMATA or the appropriate Regional Agency.

2.1.1 Components

The Contractor shall furnish Application Program Interfaces (API) and the following components for the NEPP System:

A. On-Board Payment Targets;

B. Turnstiles and/or Faregates;

C. Fare Vending Devices;

D. Handheld Validators (HVs);

E. Sales Devices;

F. Platform Validators;

G. Vehicle-based Vending and Validating Devices;

H. Parking Equipment; and

I. Central Data System (CDS) and communications networks for monitoring, control, data exchange and interfaces to legacy systems.

The Contractor shall design, install, and test the NEPP, its components and its integrated communications networks. These networks shall be responsible for the secure transmission of all data related to the NEPP System, between a centralized location and all of the NEPP System components.

The CDS shall be designed to interface with all of the segments of the NEPP System to provide a single integrated set of controls and applications for the entire NEPP System. The CDS shall store and manage all Smart Media accounts and associated data. CDS shall also provide validity information to the NEPP equipment when Smart Media-based accounts are used within the NEPP.

The NEPP shall incorporate a centralized NEPP Customer Support Center to:

J. Handle all Customer enquiries associated with NEPP Equipment and Smart Media;

K. Provide management support for Customer accounts; and

L. Fulfill all WMATA Smart Media requests.

Automated methods shall be available through most deployed NEPP equipment, such as Automatic Replenishments, to give Customers more convenient ways to replenish Smart Media, and improve Customer service.

2.1.2 Functionality

The NEPP System shall:

A. Utilize APIs for communication between the NEPP equipment installed and the CDS to facilitate the inclusion of devices, components and sub-systems supplied by multiple manufacturers under separate procurements to operate seamlessly as a single system;

B. Securely accommodate and process Smart Media offered and/or distributed by third parties such as the PIV Card and contactless credit cards;

C. Interface with, accommodate and process the data from the existing WMATA data warehouse;

D. Provide for an integrated, state-of-the-art electronic fare vending, payment, distribution, collection and processing system utilizing new payment technologies capable of interfacing with both bank and non-bank financial clearing systems for transaction settlement;

E. Include system devices that are deployed or are in a final prototype status such that their complete functionality can be verified by WMATA prior to NTP;

F. Be deployed in a phased manner to meet the needs and goals of WMATA and its Regional Agencies.

G. Quickly and efficiently verify the validity of all Smart Media used at any NEPP device and provide the necessary authentication and authorization;

H. Substantially reduce WMATA's exposure to revenue losses, including losses due to the use of invalid Smart Media, fraudulent Smart Media, as well as valid Smart Media (or an associated account) that does not contain enough value or a pass that is valid for the selected trip;

I. Maximize Customer throughput at all fare collection devices;

J. Be adaptable to innovations specific to the transit, banking and communications industries in particular, as well as other technological innovations;

K. Interface with WMATA's existing infrastructure, specifically the physical conditions at stations and their associated parking facilities;

L. Easily accommodate ongoing programs of improvement projects on the WMATA rail, bus and other systems; and

M. Support all existing modes of transportation and the needs of all existing categories of Customers, including programs for specific types of Customers.

2.1.3 Smart Media Distribution

WMATA envisions that the NEPP System will be implemented in multiple phases as identified in Sections 1 and 19. In addition, an evolving level of fare payment and collection functionality shall be available for Customer use as each phase of the NEPP implementation is successfully completed. Upon conclusion of the phased implementation process, WMATA envisions that

A. Smart Media will be distributed by WMATA and a number of other vendors;

B. Retail outlets shall also distribute Smart Media; and

C. Customers will be able to order WMATA Issued Smart Media through an NEPP Customer Support Center providing walk-up, internet and telephone support services.

The replenishment of Smart Media accounts, including associated accounts, shall occur at a variety of locations to enhance Customer convenience. Replenishment of Smart Media accounts shall be available through:

D. Fare Vending Devices located in WMATA stations,

E. Sales Devices located at WMATA sales locations,

F. Regional Agency locations using Sales Devices;

G. Customer Service Center(s); and

H. The NEPP web interface.

2.1.4 Other Transit Agencies

In addition to WMATA, transit agencies other than the Regional Agencies shall be able to obtain NEPP equipment and computer systems defined within these specifications. The NEPP equipment and computer systems shall enable these other transit agencies to select and implement any of the following operational scenarios:

A. Interface with no element of the WMATA-installed system but be a stand-alone system for that agency only;

B. Interface with certain elements of the WMATA-installed system, such as the Web-based sales;

C. Interface completely with the WMATA-installed system and operate with all of the rules and processes used by the WMATA-installed system.

Each of the above system types shall permit the agency to access and utilize all of the functions as defined for the WMATA-installed system.

2.1.5 Supplier Interface Requirements

The NEPP shall provide for the development of APIs for interoperation of the NEPP System with at least two fare collection equipment suppliers. In order to verify the operation of the APIs with equipment from these two suppliers, for equipment provided by each of the two fare collection suppliers:

A. all hardware and software CDRLs shall be submitted; and

B. all testing through the completion of functional testing for the First Article Testing shall be performed and passed.

Successful completion of the above steps shall be required in order to successfully fulfill the requirements of the NEPP.

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)
2. Americans with Disabilities Act Accessibility Guidelines (ADAAG)
3. ANSI Standard – General Purpose Paper Cards
4. ANSI Standard – General Purpose Plastic Cards
5. ANSI/IEEE Standard 828 Standard for Software Configuration Management Plans
6. ANSI/IEEE Standard 1012 -for Software Verification and Validation
7. ANSI/IEEE 730, Standard for Software Quality Assurance Plans
8. ANSI X9.2 and 8 PIN pad unique key and encryption
9. EMV® Integrated Circuit Card Specifications
10. FCC Part 15 Class B – Radio Frequency Devices
11. IAW EEIG 97s0665, ERTMS/ETCS Environmental Requirements
12. IEC-801-2 pertaining to electrostatic discharge
13. IEC 60695-11-10 1999 (Amended 2003), Fire hazard testing: part 11-10: test flames: 50 W horizontal and vertical flame test methods
14. IEC 61000-4-2, Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Electrostatic discharge immunity test
15. IEEE 802.1p Traffic Class Expediting and Dynamic Multicast Filtering
16. IEEE 802.11 n standard for wireless data communications
17. IEEE 802.11i standard for wireless data network security
18. IEEE Standard 1058, Software Project Management Plans
19. IEEE P1588 Standard for Software Documentation for Rail Equipment and Systems
20. IEC529, Definition of Protection Grades
21. ISO/IEC 7810, Identification Cards – Physical Characteristics
22. ISO/IEC 7810, Identification Cards - Financial Transaction Cards
23. ISO/IEC 7811, Identification Cards - Recording Techniques
24. ISO/IEC 7816, Identification Cards – Integrated Circuit Cards with contacts
25. ISO 9001, International Standards for Quality Management
26. ISO/IEC 10373, Identification Cards – Test Methods
27. ISO/IEC 14443 Parts 1 through 4 – Contactless Smart Card Standard
28. ISO/IEC 18092 / ECMA-340 – Near Field Communication Interface and Protocol-1 (NFCIP-1)
29. ISO 27001, Information Technology - Security Techniques - Information Security Management Systems - Requirements
30. MIL-STD 105, Sampling Procedures and Tables for Inspection by Attributes
31. MIL-STD-461E
32. MIL-STD-810F
33. National Electrical Code (NFPA 70)

Government Requirements and Industry Standards
34. National Electrical Safety Code (ANSI C2) 35. National Fire Protection Association (NFPA) 130 – Standard for Fixed Guideway Transit and Passenger Rail Systems 36. NCITS 322-2002, American National Standard for Information Technology – Card Durability Test Methods 37. Payment Application Data Security Standard (PA-DSS) 38. Payment Card Industry Data Security Standard (PCI DSS) 39. Payment Card Industry PIN Transaction Security (PCI-PTS) 40. Payment Card Industry PIN Security Requirements 41. Society of Automotive Engineers J-1113-13 Electrostatic Discharge 42. Society of Automotive Engineers J1708, J1587, J1939 43. Society of Automotive Engineers SAE J1455 Vibration and Shock 44. UL 1053 Standard for Safety Ground-Fault Sensing and Relaying Equipment 45. UL 50 3R Water Ingress Test 46. UL 751, UL Standard for Safety, Vending Machines 47. UL 60950, UL Standard for Safety of Information Technology Equipment 48. UL 969 Standard for Safety Marking and Labeling Systems 49. State, county and local building, electrical and construction codes, as applicable

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, statutes, standards, and federal rules and regulations applicable to NEPP System at the time of Notice to Proceed and shall provide this information and an explanation of how their equipment meets these requirements at the Preliminary Design Review. **CDRL 2-1**

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 PCI Compliance

Because the NEPP System shall accept credit, debit and prepaid media as a form of payment, the entire NEPP System, all NEPP devices that process credit, debit or prepaid cards, all communications and computer systems comprising the entire NEPP System and all interfaces with the existing WMATA system components, shall be in full compliance with the Payment Card Industry (PCI) standards at the time of Final Design approval. WMATA is currently a Level 1 merchant for PCI-DSS compliance.

The version of the PCI-DSS presently in effect (version 2.0) requires that the Contractor build and utilize secure data networks for the NEPP System, which protect cardholder data including the implementation of strong access control measures.

From time of initial NEPP implementation through Acceptance of the NEPP System, changes to the PCI-DSS requirements shall be incorporated into the NEPP System by the Contractor to ensure continuing PCI-DSS compliance. As a part of each implementation phase and through the conclusion of the NEPP System Warranty period as defined by the Contract, the Contractor shall utilize a PCI-DSS certification expert (i.e. currently identified by the PCI Council as a "Qualified Security Assessor") to certify the compliance with the standards in force at the time of acceptance of each phase of implementation, as well as for final NEPP System acceptance.

The Contractor shall also perform the following activities through the conclusion of the NEPP System warranty period:

- Perform quarterly scheduled scanning for network security as well as internal and external vulnerabilities and correction of such vulnerabilities based on the published Security Scanning Procedures;
- Perform the annually required penetration testing;
- Track and monitor all access to network resources and cardholder data;
- Routinely perform Data Security Assessments.

Contractor shall furnish documentation at the Preliminary Design Review and Final Design Review to provide full details for the NEPP System's compliance with all aspects of PCI-DSS. **CDRL 2-2**

Contractor shall identify any existing WMATA systems which are impacted by the NEPP System that are not PCI compliant and shall notify WMATA of these deficiencies not more than thirty (30) days after becoming aware of them. **CDRL 2-3**

2.2.2 PA-DSS Compliance

All System software that is used for the processing of credit card or debit card data shall meet of all requirements of the Payment Application Data Security Standard. Contractor shall identify and notify WMATA of any changes to the standards that are instituted between the time of Notice to Proceed and System implementation and certify that their software meets these requirements.

Contractor shall furnish documentation at the Preliminary Design Review and Final Design Review to provide full details for the NEPP System's compliance with all aspects of PA-DSS. **CDRL 2-4**

2.2.3 Additional PCI Standards, Information Supplements and Guidelines

In addition to the above, the NEPP system shall be compliant with all additional applicable PCI standards, Information Supplements and Guidelines in force at the time of Contract Award, unless written approval is provided by WMATA at its sole discretion. Contractor shall identify these applicable PCI standards, Information Supplements and Guidelines not more than ninety (90) days after NTP. **CDRL 2-5**

2.3 Design Requirements

All equipment shall be ergonomically designed and constructed in a manner that is easy to use, functional, safe, and ADA compliant. Additionally, the design of all NEPP 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. Equipment intended for use by or for Customers shall be aesthetically pleasing and easy to understand.

All equipment 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 as defined in Section 2.7.

2.3.1 System Security

The NEPP System shall provide WMATA with a complete, high-security method for collection and control of revenues. In the event security is compromised at any time during the design, development, installation, and testing stages of the system, the Contractor shall immediately inform WMATA as soon as the condition is detected. 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 NEPP shall be restricted to designated users with the highest level of security clearance. Additional password authorization shall be required to perform this function. At no time shall any password be displayed on any screen in the revenue system.

A system security plan shall be developed and presented to WMATA for review and approval within ninety (90) days after NTP. **CDRL 2-6**

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.

2.3.2 Product Supply and Availability

The NEPP System, its equipment, 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.

2.3.3 Prior Service Performance

Design of all equipment of the NEPP System 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.

2.3.4 Fault Tolerance and Recovery

The NEPP System is the central point of fare payment interaction between WMATA and its Customers, and system failure shall have an immediate and adverse impact on WMATA`s operations and revenues. The Contractor shall design the system and equipment 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.

2.3.5 Modular Design

Each of the basic functions within the NEPP field equipment shall be performed by 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.

NEPP equipment 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.

Contractor shall provide a list of all replaceable modules at the Preliminary Design Review for WMATA review and approval. **CDRL 2-7**

2.3.6 Maintenance/Test Mode

Each type of NEPP equipment installed which interfaces with the Customer shall incorporate a test mode. In this mode, the equipment shall only produce and process test Smart Media. Non-test Smart Media shall be unaffected but shall be reported as "invalid" both at the field device and by the CDS 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 equipment 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 at the CDS. This shall be recorded as an event and reported to the CDS.

2.3.7 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.

The equipment 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.

By following instructions given on and by the equipment, an inexperienced Customer must be able to quickly understand all types of media purchase options and the pass initialization process. Facilitated focus groups of WMATA Customers and non-customers shall be utilized by the Contractor to assist in designing the human elements of the NEPP System.

All NEPP equipment controls and operating mechanisms shall be operable with one hand, without requiring tight grasping, pinching, twisting, force, or pressure.

NEPP equipment and other elements of the system to be used by WMATA users 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.

2.3.8 Environmentally Friendly Design

All NEPP equipment design and the selection of all NEPP equipment components shall be performed 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 of the NEPP. 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 severe adverse impact on system deployment.

2.3.9 Safety

NEPP equipment 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.

Unless specified otherwise in other equipment Sections of this document, NEPP equipment cabinets having surfaces that are exposed to the public, including all fixed equipment used by WMATA located in stations, shall be stainless steel or other revenue service proven finish, as approved by WMATA.

All interior surfaces and components with which Customers or maintenance and service 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 provided at the Preliminary Design Review for review and at the Final Design Review for approval by WMATA. **CDRL 2-8**

2.3.10 Locks and Security

All NEPP equipment provided shall be constructed to provide maximum protection for equipment and revenue contained therein. 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 all NEPP equipment 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. Revenue servicing personnel, and

C. Money processing personnel at the revenue-counting facility of WMATA or its designated revenue collection and processing agent.

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

For Fare Vending Devices and other NEPP devices where cash is stored, all locks for access to the interior of the NEPP equipment shall be electronic locks of type Cyberlock® or WMATA-approved equivalent. The electronic locks shall not be affected when there is a main power failure to the equipment; i.e., opening and closing of the electronic lock shall not be contingent on main power being available.

The electronic locks shall operate without being adversely affected by electromagnetic interference (EMI) and radio frequency interference (RFI) emissions; the electronic locks shall comply with the EMI and RFI requirements identified in Section 2.3.13. 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.

Provided as part of the NEPP system shall be all hardware and software to permit WMATA to manage, administer, report on and modify as necessary, the operation of the NEPP System security system utilizing the Cyberlock® system.

Locks to access the interior of NEPP devices without cash, and to access and remove the revenue containers and other interior modules shall be high security locks. These locks shall be keyed differently from other device locks. To the greatest extent possible, locks for accessing and removing interior modules shall be keyed alike.

Commencing with initial implementation of NEPP equipment, 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.

All doors, panels and covers, which provide access to the interior of the equipment or access to cash storage modules, 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), regardless of whether or not the equipment contains revenue.

2.3.10.1 Internal NEPP Device Access

For all NEPP device types installed in the field, Smart Media shall be used to identify a technician to the NEPP device being accessed. The Smart Media for all technicians need not be of a single Smart Media type for all technicians. Smart Media for access to equipment shall be using any type of credential accepted by the NEPP as long as the credential is identified as a valid WMATA credential.

The Smart Media shall be read and verified against an internal list, stored within the NEPP device. This list shall be updated with new records each time the equipment communicates with the CDS. If the Smart Media is not identified on the internal list, an alarm shall be immediately sent to the CDS and reported as an intrusion.

If the Smart 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 Smart Media/PIN as authentic and valid shall be performed before access to the interior of the machine is permitted. 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.

2.3.11 Useful System Life

All NEPP equipment and associated software furnished under this Contract 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 the NEPP system's 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 NEPP. The NEPP equipment shall also be capable of incorporating technology upgrades without undue redesign of components or modules, extensive software revisions or other similar excesses.

2.3.12 Operating Environment

All NEPP equipment shall be designed for continuous reliable operation in revenue service under anticipated environmental conditions found within the region to which they are exposed.

2.3.12.1 Station- and Facilities-Based Equipment

Parking equipment and most station equipment, including FVDs, turnstiles/faregates, and platform validators, 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 for the NEPP. 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 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 the NEPP 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 140°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
H.	Wind Speed:	Up to 90 mph, any direction
I.	Freezing Precipitation	Up to 3 inches per hour

J.	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 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

NEPP equipment 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, with Operational Requirements as per Section 2.8.2.2.2, Track (line side) and Track Side Equipment – Vibration, in accordance with the power spectral density (PSD) defined in Figure 6; and Test Requirements as per Section 2.8.4.5, Vibration: 0.23g rms, frequency range 0 to 200Hz.

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 per paragraph 2.8.2.2, Track (line side) and track side equipment. Test requirements shall conform to the 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.

This shall be executed with all the internal components.

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).

NEPP equipment operations shall not be adversely affected by the electromagnetic fields generated by the 600 Volt DC traction power system. The system shall conform to the following requirements:

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

G. FCC Part 15, Subpart B Class A (Radiated emissions), pertaining to radiated susceptibility;

H. SAE J-1113-13 pertaining to electrostatic discharge.

Vandalism

NEPP devices shall also meet the requirements as identified in Section 2.3.15. Contractor shall provide documentation for the requirements of Section 2.3.15 at the Conceptual Design Review for WMATA review and approval.

If such documentation is not approved by WMATA, these requirements shall be verified as part of the Environmental testing.

2.3.12.2 Handheld Equipment

All handheld equipment shall operate under the environmental conditions specified herein without failure, degradation without limitation.

A.	Operating Temperature	0° F to 122° F
B.	Storage Temperature	-22° F to 150° F
C.	Thermal Shock	60° F within 15 seconds
D.	Electromagnetic Interference	10 V/m, bands a, b, c; 300V arcs in nearby equipment
E.	Shock and Vibration	Up to 5g (instantaneous)

All handheld equipment shall remain operational in the presence of the airborne particles and other contaminants common to a rail transit environment.

2.3.12.3 On-Board Equipment

On-board equipment shall remain operational to meet the specified technical requirements in the presence of contaminants, including but not be limited to any airborne particles (including dust generated by brakes, wheels, and rails), greases, oils, and other contaminants accumulated on Smart Media.

Local Climate

The equipment on the vehicle shall not suffer any degradation in performance while operating under the following environmental conditions:

A.	Sunlight	None to full, direct behind a glass windshield
B.	Storage Temperature:	-22º to + 140ºF
C.	Operating Temperature:	0º to + 122ºF
D.	Thermal Shock:	Up to 50°F in 2 hours

E.	Relative Humidity	13% to 99% R.H including condensation
F.	Vibration	As identified below
G.	Shock:	As identified below
H.	Airborne Dust:	Up to 180 micrograms per cubic meter, with iron and salt particles
I.	Inclination	0º to 10º off vertical
J.	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 which may come in contact with equipment

Electromagnetic Interference

EMI and RFI radiating from equipment on the vehicle, including vehicle propulsion, radio, lights, electronic destination signs, air conditioners, and generators shall not affect the operation of the equipment.

The equipment shall not emit measurable EMI or RFI that produces harmful interference with any other on-board electronic device or system.

The same requirements as identified in Section 2.3.12.1 shall apply.

Rain, Moisture & Humidity

As a result of Customer boardings in rainy and humid conditions, the insert slots can be expected to become wet due to transfer from Customer clothing, etc. 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.

Shock

Onboard NEPP equipment shall comply with SAE J1455 for shock.

Vibration

Onboard NEPP equipment shall comply with SAE J1455 for vibration.

2.3.12.4 Interior Environment

All NEPP System equipment installed in office and other indoor locations, including Sales Devices, and the CDS, which are not subject to the rigors of the elements shall be able to properly function and not suffer any degradation of performance under the following conditions:

A.	Air Temperature:	40º F to 99º F.
B.	Relative Humidity:	20% to 95% non-condensing.
C.	EMI:	Meeting the requirements of Section 2.3.12.1
D.	Airborne Dust:	Meeting the requirements of Section 2.3.12.1, item G
E.	Inclination:	Meeting the requirements of Section 2.3.12.1, item J
F.	Water/Solvents:	Meeting the requirements of Section 2.3.12.1, item K

If an item of equipment is planned to be installed and or operated in both the external and interior environments, the more stringent requirements shall apply.

2.3.13 General Electrical Requirements

NEPP System 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. **CDRL 2-9**

All equipment, enclosures, and assemblies, shall be electrically grounded, conforming to NEC requirements. All electrical infrastructure and components installed to support NEPP System components shall facilitate electrical power distribution in accordance with these Technical Specifications.

Contractor shall ensure that final connections to all NEPP equipment and components are provided. All installation activities shall proceed in stages, in accordance with the WMATA approved Installation and Deployment Schedule (see Section 19).

All Contractor installation activity scheduling and proposed installation drawing submittals shall be submitted in accordance with provisions of Section 18 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, Weather Pack connectors, or other WMATA-approved environmentally sealed connectors shall be used. No butt connectors shall be used in any type of NEPP equipment or power supply source connected to the equipment. 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 in the vehicles.

2.3.13.1 Conduit Requirements

Installed conduit shall be classified by UL as suitable for the purpose specified. Conduit size shall be in accordance with ANSI/NFPA 70. Conduit no less than 13/16 inch in size shall be used unless specified.

Underground Locations

Conduit shall be installed no less than 5 feet from Foundation Wall. Thickwall non-metallic conduit shall be used for all underground installations. For "In or Under Slab on Grade" conduit installation, rigid steel conduit shall be used with a size no less than 1 inch.

Outdoors Locations Above Grade

Rigid metal conduit shall be used for all conduit installation in outdoor locations above grade.

In Slab Above Grade

Rigid metal conduit shall be used for all conduit installation in slab above grade. "In Slab" conduit shall be restricted to a maximum conduit size of 13/16 inch and 5/8 inch for conduits crossing each other.

Wet and Damp Locations

Rigid metal conduit shall be used for all conduit installation in wet and damp locations.

Dry Locations

Rigid steel conduit shall be used for all conduit installation in concealed and exposed locations.

Metal Conduit

Rigid Steel Conduit in accordance with ANSI C80.1 shall be used where rigid steel conduit is required. Fittings and conduit bodies in accordance with ANSI/NEMA FB 1 shall be used to match conduit material.

Flexible Metal Conduit

Flexible Metal Conduit shall utilize Interlocked Steel Construction. Fittings in accordance with ANSI/NEMA FB 1.

Liquidtight Flexible Metal Conduit

Liquidtight Flexible Metal Conduit shall utilize Interlocked Steel Construction with PVC jacket. Fittings in accordance with ANSI/NEMA FB 1 shall be used.

Fiberglass Reinforced Epoxy Conduit

Conduit for emergency power feeder shall be rigid non-metallic, high impact and compressive strength, with low coefficient of friction fiberglass reinforced epoxy. Conduit shall conform to the requirements of NEMA TC14 Part B and shall be UL listed in accordance with Article 347 of the NEC for underground or exposed use according to the use intended. Fiberglass reinforced epoxy (FRE) duct and fittings shall be manufactured from pure, high grade, filament wound fiberglass epoxy and shall have the following properties as a minimum:

1. Tensile strength (axial): 11,000 psi when tested per ASTM D2105.
2. Modulus of elasticity: 1,300,000 psi when tested per ASTM D2105.
3. Thermal conductivity: 0.166 Btu(th) ft/hour/ft^2/°F (288/w/m.k).
4. Coefficient of linear thermal expansion: 1.37 x 10^{-5}/^{0}F.
5. Specific gravity: ounces/$inches^3$.
6. Temperature range: 65 °F to 300 °F.
7. Dielectric strength: 500 Kv/inch when tested per ASTM D348.
8. Dissipation factor: 0.5% average at room temperature when tested per ASTM D348.

Where ducts are to be used in corrosive areas, isophthalic polyester resin shall be used in both the liner and the overlap. Fiberglass duct smaller than 4 inches in size shall have an average wall thickness of 1/16 inch. Sizes larger or equal to 4 inches shall be heavy wall type with an average wall thickness of 3/32 inch. The ducts shall be thoroughly cured and shall not contain any material in sufficient quantities to cause damages to cables.

They shall be straight and shall have a circular bore with the inner surface smooth and free from dents, obstructions or any other defects which would cause damage to cables. The bores shall pass freely a mandrel 3 feet in length and ¼ inch less in diameter than the nominal diameter of the duct. Plastic couplings and straight adaptors shall be suitable in size and design for the conduit with which they are to be used. Bends (90 degrees, 5 feet radius) shall be provided at vertical or horizontal curves and as indicated or as directed by the Project Manager.

Conduit Expansion Fittings shall be fabricated from material similar to the type of conduit with which they are to be used. Each fitting shall include a factory installed packaging ring, designed to prevent the entrance of moisture, a pressure ring, and a grounding ring or grounding conductor for metallic expansion couplings.

2.3.13.1.1 Conduit Installation

Conduit shall be installed in accordance with NECA Standard of Installation. Related conduits shall be grouped and supported using conduit rack. Conduit rack shall be constructed using steel channel and shall be constructed to provide space on each for 25 percent additional conduits. Conduit shall not be supported using wire or perforated pipe straps. Clearance of 3/16 inch between conduit and surfaces with temperatures exceeding 104°F shall be maintained. No more than the equivalent of three (3) 90-degree bends between boxes shall be installed.

Conduit bodies shall be used to make sharp changes in direction, such as around beams. A hydraulic bender shall be used to fabricate elbows and bends in exposed parallel conduit runs. Factory elbows shall be used for non-exposed non-parallel runs. Fittings that accommodate expansion and deflection where conduit crosses control and expansion joints, shall be used. Suitable caps shall be used to protect installed conduit against the entrance of dirt and moisture.

Conduit passing through a masonry or concrete wall, floor or partition shall be provided with a sleeve made from standard weight steel pipe with smooth edges, securely and neatly cemented in place. Conduit passing through a frame or metal partition shall be provided with sleeve made from 2¾ feet galvanized sheet metal, securely fastened in place.

Sleeves shall be two pipe sizes larger than any conduit. Sleeves imbedded in concrete floors or walls shall be placed in the forms before concrete is poured; sleeves shall have integral waterstop flanges, where said sleeves shall receive either watertight or hydrostatic seals.

Sleeves for electrical raceways passing through ceiling air plenum walls or the floor above airtight and fire resistant ceilings shall be sealed in a manner similar to that specified for watertight sleeves. This shall also apply where conduits leave heated areas and enter unheated areas. Contractor shall be responsible for the proper location and alignment of all sleeves for installation activities before and during concrete placement.

2.3.13.1.2 Conduit Identification

Conduit markers shall be used for each conduit longer than 19½ feet. Spacing between conduit markers shall be no less than 20 feet. The following color code shall be used for the identification of conduit:

1. 480 Volt System: Green
2. 208 Volt System: Blue
3. Fire Alarm System: Red
4. Telephone System: Black
5. 15 KV System: Orange

2.3.13.2 Wire and Cable Requirements

Where the Contractor shall be required to install wiring and cabling to support the installation of NEPP System equipment, the following requirements shall be applicable. Building and facilities wire and cable shall be single conductor insulated copper wire. Insulation shall be in accordance with ANSI/NFPA 70 and shall be Type THHN/THWN insulation for feeders and branch circuits. The following wiring connectors shall be permitted:

- Split Bolt Connectors;
- Solderless Pressure Connectors;
- Spring Wire Connectors;
- Compression Connectors.

The following wiring methods shall be permitted:

- Concealed Dry Interior Locations: Type TW, THW, THHN/ THWN, XHHW 75% insulation shall be used in raceway;
- Exposed Dry Interior Locations: Type THHN/THWN 75% insulation shall be used in raceway;
- Above Accessible Ceilings: Type THHN/THWN 75% insulation shall be used in raceway;
- Wet or Damp Interior Locations: Type THHN/THWN 75% insulation shall be used in raceway;
- Exterior Locations: Type THHN/THWN, XHHW 75% insulation shall be used in raceway;
- Underground Installations: Type THHN/THWN, XHHW 75% insulation shall be used in raceway.

2.3.13.2.1 *Cable Installation in Conduit, Cable Trays, Ducts, and Raceways*

During the installation of cables in conduits, cable trays, ducts, and other raceways the cable manufacturer's recommended pulling tension shall not be exceeded. A suitable lubricating medium, harmless to the cable jacket, shall be used when pulling cables into a conduits pipes, cable trays, or duct banks. No oil or grease substances not specifically manufactured for cable installation shall be permitted for such use.

Contractor shall use adequate lubrication when installing cables in conduits or raceways. Any pulling compounds shall be compatible with the finish of the wires and cables provided.

2.3.13.2.2 *Cable Attachment and Support*

Lengths of cables which are not installed in conduits or other raceways and are run inside equipment rooms shall be secured to cable trays or cable ladders using nylon cable ties and attached to walls and backboards using nylon cable clamps or hangers or using a plastic wiring system such as manufactured by Panduit, or approved equal.

Cables shall be attached or otherwise supported at intervals not to exceed eighteen inches (18"). Cables above accessible ceiling shall be supported using spring metal clips or nylon cable ties to support cables from structure. Cables shall not be allowed to rest on ceiling panels. Cable supports shall not be fastened or attached to pipes, ducts, mechanical equipment and/or conduit.

2.3.13.2.3 Strain Relief

Provide sufficient strain relief (slack) in all cables, cable conductors, and wiring to avoid stress on all cables, wires, and wiring connections.

2.3.13.2.4 Bends

Cables shall not be bent to a radius less than ten (10) times the diameter of the cable, or less than the manufacturer's recommended minimum bending radius, during installation or as final install.

2.3.13.2.5 Cable Continuity and Integrity

All cables shall be continuous and without splices between the specified termination locations. The cable termination points shall be located within communication cabinets, equipment enclosures, splice cases, and equipment termination boxes.

2.3.13.2.6 Termination and Identification

All cables shall be terminated in standard order, according to the EIA/TIA and ICEA color codes.

Termination of each end of a cable shall be using polarized, mating connectors with positive retention devices and suitable cable strain relief, allowing ready exchange of equipment and components if required without unsoldering or otherwise disassembling the cable connection.

All aluminum conductors shall be terminated with tin-plated aluminum-bodied compression connectors only. Suitable reducing connectors or mechanical connector adaptors shall be used for connecting aluminum conductors to copper conductors. Split bolt connectors shall be used for copper conductor splices and taps, 0.02 inches^2 and larger. Solderless pressure connectors shall be used with insulating covers for copper conductor splices and taps, 0.012 inches^2 and smaller. Insulated spring wire connectors shall be used with plastic caps for copper conductor splices and taps, 0.008 inches^2 and smaller. Individual cables shall be identified at each cable termination with self-adhesive labels. All spare pairs in each cable shall be terminated and identified.

All wiring and cabling shall be uniquely identified in terms of equipment to and from connections. This identification shall be shown on all wiring, electrical schematics, and location drawings. Those components that have been installed by the Contractor as a supplement to the original design shall be identified.

All wires and cables shall be identified by circuit numbers in all cabinets, boxes, manholes, wireways and other enclosures and access locations and at all terminal points.

All cables shall be labeled at least at each end of every cable section; using WMATA approved cable tags or labels. Inside plant cables shall be labeled using WMATA approved self-adhesive waterproof labels; outside plant cables shall be labeled using WMATA approved waterproof plastic cable tags. Samples of conductor identifications shall be provided at the Conceptual Design Review for review and approval by WMATA. **CDRL 2-10**

All labeling shall:

A. Meet the legibility, defacement, exposure and adhesion requirements of UL 969;

B. Be preprinted or computer printed type. ⅛ inches letters shall be used for identifying individual equipment and loads. ¼ inches letters shall be used for identifying grouped equipment and loads. Hand written labels are not acceptable;

C. Use vinyl substrate with a white printing area and black print. For cable jackets that are white, provide cable label with printing area that is any color other than white, preferably orange or yellow, so that labels are easily distinguishable;

D. Be flexible vinyl or other substrates to apply easily and flex as cables are bent;

E. Use aggressive adhesives that stay attached even to the most difficult to adhere to jacketing.

All record documentation that is necessary to complete identification of equipment and components in terms of location, equipment type, and any other information required to make the ID unambiguous shall be submitted for WMATA review and approval at the Conceptual Design Review. **CDRL 2-11**

2.3.13.3 Boxes, Cabinets, Enclosures and Panel Boards

Where the Contractor shall be required to install wire and cabling infrastructure to support the installation of NEPP System equipment, boxes, cabinets and enclosures, and panel boards shall be installed as necessary in accordance with the following requirements.

2.3.13.3.1 Boxes

Outlet Boxes

Outlet Boxes shall be sheet metal outlet boxes or cast boxes. Sheet metal outlet boxes shall be in accordance with ANSI/NEMA OS 1 and shall be made of galvanized steel. Boxes shall be rated for the weight of equipment which it shall support. Concrete ceiling boxes may be used. Cast boxes in accordance with NEMA FB 1 shall be Type FD, aluminum, or cast ferroalloy. Cast boxes shall utilize gasketed covers supplied by the box manufacturer.

Pull and Junction Boxes

Pull Junction Boxes shall be sheet metal boxes or surface-mounted cast metal boxes. Sheet metal outlet boxes shall be in accordance with ANSI/NEMA OS 1 and shall be made of galvanized steel. Surface-mounted cast metal boxes in accordance with NEMA 250 shall be Type 4, flat-flanged, surface-mounted junction boxes.

Cover legends on all Outlet and Pull and Junction Boxes shall read “ELECTRIC.”

2.3.13.3.2 Cabinets and Enclosures

Cabinets

Cabinet boxes shall be made of NEMA 4X rated, stainless steel. Boxes shall be 2 feet wide by “as required” inches high by 6 inches deep. Backboards for mounting terminal boards shall be made of plywood and shall be ¾ inch thick. Cabinet fronts shall be surface type with concealed trim clamps, concealed hinges, and flush lock keyed to match branch circuit panel boards. Cabinets shall be finished with gray baked enamel. Metal barriers shall be provided to separate compartments containing control wiring operating at less than 50 volts from power wiring.

Terminal Blocks

Terminal blocks shall be ANSI/NEMA ICS 4 compliant. Power Terminals shall be of unit construction type with closed back and tubular pressure screw connectors, rated 600 volts. Signal and Control Terminals shall be of modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts. A ground bus terminal block shall be provided with each connector bonded to enclosure.

2.3.13.3.3 Panel Boards

Distribution Panel Boards

Panel boards shall be NEMA PB 1 compliant and of the circuit breaker type. Panel boards shall be rated for reliable operation at a temperature of 115 °F. The panel board bus shall be made of copper with a ground bus provided in each panel board. Minimum integrated short circuit rating shall be as noted on the schedules. Molded case circuit breakers shall be in accordance with NEMA AB 1.

Circuit breakers shall be provided with integral thermal and instantaneous magnetic trip in each pole. Circuit breakers shall be UL listed as Type HACR for air conditioning equipment branch circuits. Circuit breaker accessory trip units and auxiliary switches shall be provided as indicated.

Branch Circuit Panel Boards

Lighting and Appliance Branch Circuit Panel Boards shall be NEMA PB 1, circuit breaker type. The panel board bus shall be made of copper with a ground bus provided in each panel board; insulated ground bus shall be provided where scheduled. Minimum integrated short circuit rating shall be as noted on the schedules. Molded case circuit breakers shall be in accordance with NEMA AB 1. Bolt-on type thermal magnetic trip circuit breakers with common trip handle for all poles shall be used. Circuit breakers shall be UL listed as Type SWD for lighting circuits. UL Class A ground fault interrupter circuit breakers shall be used where applicable. Tandem circuit breakers shall not be used.

2.3.13.4 Wiring Devices

Where the Contractor shall be required to install wiring devices to support the installation of NEPP System equipment, the following requirements shall be applicable.

2.3.13.4.1 Receptacles

General-duty duplex type receptacles shall be 2-pole, 3-wire grounding, with green hexagonal equipment ground screw, ground terminals and poles internally connected to mounting yoke, 20-amperes, 125 volts, with metal plaster ears, side wiring, and NEMA configuration 5-20R unless otherwise indicated.

Duplex receptacles connected on emergency power shall be of red color. General-duty grounding type duplex receptacles, with integral ground-fault circuit interrupters shall be grounding type UL-rated Class A, Group 1, 20-amperes rating, 125-volts, 60Hz, with solid-state ground-fault sensing and signaling circuitry with 5 milliamperes ground-fault trip level. The grounding type duplex receptacle shall be equipped with a 20-ampere plug configuration, NEMA 5-2OR, and shall include push-to-test capability.

2.3.13.4.2 Wall Plates

Duplex receptacle wall plates shall be provided with types, sizes, ganging and cutouts as required. All plates for multiple gang requirements shall be one piece combination. Wall plates shall utilize metal screws for securing plates to devices, screw heads colored to match finish of plates, and plates colored to match wiring devices to which attached. Receptacle circuit numbers shall be identified on plates with engraved or etched designations with 3/16 inch high block type letters filled with black enamel.

2.3.13.4.3 Grounding and Bonding

Receptacles shall utilize existing grounding electrode systems in compliance with NEC 250. Where no grounding electrode systems exist, Contractor shall supply a Grounding Electrode System in compliance with NEC 250. The Grounding System shall provide a system resistance of 5 ohms. The rod electrode shall be made of copper-clad steel and shall have a diameter of 5/8 inch and shall be no less than 10 feet in length.

Mechanical connectors shall be made of bronze. Wiring for the grounding system shall utilize stranded copper. Wiring used for connecting Foundation Electrodes shall have a cross sectional area of 0.196 square inches. Wiring used for connecting Grounding Electrode Conductors shall be sized to meet NFPA 70 requirements. Separate insulated grounding conductors shall be provided within each feeder and branch circuit raceway.

2.3.13.5 Electrical Identification

Contractor shall install electrical identifiers, tags, and signs for all electrical work completed as required by governing regulations and authorities to ensure the safety of persons in the vicinity of electrical components. Approved forms of electrical identification are as follows:

Plasticized Tags

Manufacturer's standard pre-printed or partially pre-printed accident-prevention and operational tags, of plasticized card stock with matte finish, suitable for writing, shall be used where provided. Tags shall be installed with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples: DANGER, CAUTION, DO NOT OPERATE).

Baked Enamel Danger Signs

Manufacturer's standard "DANGER" signs of baked enamel finish on 1/32 inch steel with standard red, black and white graphics shall be used. Sizes shall be 14 inches by 10 inches except where 10 inches by 7 inches is the largest size which can be applied where needed, and except where larger sizes are needed for adequate visibility. Signs shall include recognized standard explanation wording (as examples: HIGH VOLTAGE, KEEP AWAY, BURLED CABLE, DO NOT TOUCH SWITCH). In addition to installation of danger signs required by governing regulations and authorities, appropriate danger signs shall be installed at locations indicated and subsequently identified by WMATA or WMATA authorized personnel as constituting similar dangers for persons in or about project.

Lettering and Graphics

Contractor shall utilize standard abbreviations, graphics and other designations used in electrical identification work to ensure proper identification and operation/maintenance of the electrical components and NEPP equipment.

2.3.13.6 Quality Control

Contractor shall perform Quality Control activities in accordance with Section 18 to demonstrate workmanship, operation, and performance of all electrical installation activities completed. Tests shall be performed in the presence of inspectors of agencies having jurisdiction, if required. Contractor shall furnish all materials required for Quality Control activities. Equipment and systems found inoperative or defective shall be repaired, replaced and re-tested.

2.3.14 Power Requirements

2.3.14.1 Station and Facilities Equipment

NEPP System components shall be capable of the following:

A. Operating on source power of 110 VAC (nominal) +/-10%, single phase, 3 wire, 60 Hz (+/-1%);

B. Normal operation while ignoring micro cuts in the power supply of up to 15 milliseconds, with a recurrence of 100 milliseconds;

C. Withstanding the following voltage excursions:

1. Sag: - 15%
2. Surge: +15%
3. Transient Impulse: 75 volts
4. Common Mode Noise: 5 volts

D. Completing transactions in–process, retaining data and shutting down in an orderly manner in the event of loss of electrical power;

E. Returning to full operational status after a power failure without manual intervention, adversely affecting the current operational situation or the integrity of stored data.

NEPP equipment shall include adequate filters and components in order to regulate the supplied voltage and render it devoid of power spikes and noise. Adequate protection against transient surges shall be incorporated to the extent necessary to prevent damage to electronic components.

2.3.14.2 On-Board Equipment

All on-board NEPP equipment shall be designed to operate reliably without malfunction from the vehicle's direct current power source, which is between 9VDC through 32 VDC.

The equipment shall be protected against damage, loss, or modification of data caused by:

A. Lower or higher voltage in the range of zero (0) to fifty (50) volts;

B. Reverse polarity of the input voltage;

C. Temporary voltage drops associated with starting of vehicles;

D. Fluctuating voltages between the maximum and minimum voltages identified above.

On-board NEPP equipment shall include adequate filters and components in order to regulate the supplied voltage and render it devoid of power spikes and noise. Adequate protection against transient surges shall be incorporated to the extent necessary to prevent damage to electronic components.

Sensing means shall be incorporated within the NEPP equipment power supply to cause the on-board NEPP equipment to be switched off automatically if the supply voltage increases or decreases to levels beyond the voltage tolerance supplied. This sensing means shall also facilitate automatic restart once voltage levels are within the required levels. Fuses and other similar consumable items shall not be permitted as the sensing means identified above. Neither loss of nor reinstatement of power shall not result in any corruption of the data in memory.

2.3.15 General Structural and Material Requirements

The NEPP equipment 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 exterior NEPP equipment shall be constructed of non-rusting stainless steel (Grade 304L) with a random orbital finish or other finish as approved by WMATA. FVD bases, POFM bases and faregate / turnstile baseplates shall be constructed of Grade 316L stainless steel.

B. On-board equipment and handheld devices shall be constructed of suitably rugged materials, and may include reinforced plastic resins.

C. 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.

D. NEPP equipment 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 400 pounds to one square inch to any part of the enclosure;

E. NEPP equipment 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;

F. NEPP equipment 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;

G. All floor-mounted NEPP equipment shall be arranged to distribute the equipment weight over the mounting base evenly;

H. Floor-mounted NEPP equipment shall be capable of being anchored into locations other than station platforms, such as building floors, mezzanine floors, and on concrete slabs;

I. For all NEPP equipment, 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.

2.3.16 Vandalism Protection

For protecting against vandalism and burglary for each NEPP device type, the following requirements shall be met:

A. All latches shall be secure and robust.

B. No external screws shall be used with out 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.

2.3.17 Software Requirements

Software for the NEPP devices and CDS 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 in any NEPP device or sub-system. Versions of third party commercially available software shall be approved at Final Design Review. **CDRL 2-12**

2.3.17.1 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. No proprietary languages or code generating systems are allowed. 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.

2.3.17.2 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 (DVD), 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.

2.3.17.3 Capacity

CDS software shall operate without degradation of function, speed or response time when meeting the following:

- Simultaneous communication with up to 6,000 items of NEPP devices installed;
- Processing up to 75,000 transactions per minute from those NEPP devices;
- Processing a total of up to 700 million transactions in a year; and
- Processing a minimum of 10 million transactions a day.

In addition, when a transaction is completed, the transaction record shall be properly stored within the CDS data base within one (1) minute.

The CDS shall provide WMATA with the ability to prioritize the transactions and messages received by the CDS and to change those priorities to suit their operational requirements. A minimum of ten (10) priorities shall be provided. Initially, the highest priority shall be provided for passenger uses of Smart Media at a NEPP device with the next highest priority for alarms and status changes.

This information is provided to assist the Contractor in estimating the size, communications throughput, and minimum memory requirements of the NEPP System. The ability to accommodate two times the above number of transactions shall be included in the base

system implemented, providing for expansion of the CDS to three (3) times the above stated minimum total transactions per day..

2.3.17.4 Redundant Data

All data for all NEPP equipment shall be stored in two physically separate locations within each device to provide for the best data security and data redundancy.

2.3.17.5 Communication

Software shall be capable of supporting operations over multiple, disparate telecommunications/data networks. The NEPP 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.

2.3.17.6 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.

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

2.3.17.7 Configuration Management

The Contractor shall devise and implement a procedure for management of the addition, alteration, or deletion of hardware, software, or telecommunications. This method shall be provided for WMATA review and approval at Conceptual Design Review. **CDRL 2-13**

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 for tracking software changes relative to all NEPP equipment and devices. 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, on which vehicles, and also which versions were used in the past. **CDRL 2-14**

The Contractor shall submit a final software configuration for each NEPP device at the time of system acceptance in an electronic format as approved WMATA. **CDRL 2-15**

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.

2.3.17.8 Software Design

Design criteria identified in this section, unless otherwise indicated, apply to all software for all devices and all computer and communications systems in the NEPP System. Additional software design criteria shall be defined as necessary in the appropriate sections of this document.

The Contractor shall utilize a Software Quality Assurance Plan in accordance with ANSI/IEEE Standard 730. The plan shall describe the mechanism for orderly software development. The Contractor shall conduct the overall design, the partitioning of the requirements to the subsystems, and the integration of the subsystems into the complete system

The Contractor Software Verification and Validation Plan (SVVP) shall describe the integration of the subsystems to cover the requirements of the entire system.

Software shall be sufficiently robust, so that the system can recover from error conditions and power losses with a minimal impact on operations. Software shall include provisions for setting and verifying date and time, with automatic adjustments for leap year, and the programmable setting of automatic daylight savings time changeovers.

Software modules shall be designed with flexibility in mind, and be clearly and well documented in English.

The operating systems for all equipment and computer systems shall be versions of which are commercially available at the time of Notice to Proceed and supported through the planned final acceptance date. Server and workstation operating system software shall be fully multi-tasking, and capable of executing multiple concurrent applications programs without delays detectable by the users.

Application software shall be fully integrated with the operating system to support all required functions of the applications programs in both a networked and a stand-alone environment. The software shall allow for the distribution of software modifications to all NEPP devices from a centralized location.

Microcomputers, or any other system components, shall not rely on, or employ, the use of EPROMs. All code updates at the device level shall be implemented without requiring mechanical intervention to accomplish the change.

2.3.17.9 Coding

Software shall be coded in a non-proprietary language. Except as expressly permitted by WMATA, hard-coding of operational parameters and other system configuration values shall be prohibited. All programs and routines shall reference central tables of codes and values for each function. A process shall be provided to facilitate updating of tables prior to implementation of changes, with multiple future effective dates designating the actual implementation of each change. No less than seven (7) years of effective date code and values shall be maintained so that reports can be constructed from historical data spanning changes in fares and other parameters.

Software error codes shall be table driven, include the manner in which the error can be corrected, and contain easily understood explanatory text. Entries shall be available for editing at the CDS level with the ability to add additional error codes as required. The procedure for these modifications shall be provided to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 2-16**

2.3.17.10 Software Maintenance and Related Tools

The Contractor shall provide software development workstations, including all of the software and software development tools used by the suppliers. The complement of equipment shall include all compilers, assemblers, linkers, in-circuit emulators, and other such tools that are used for software development.

All associated manuals shall be provided. Development tools and software, which are provided to WMATA, must be the same version as used by the suppliers. The system shall allow software modifications and tests of all transit related software on this procurement. The complete complement of software development/ modification tools shall be delivered such that software modifications, if desired, can be made on-site during acceptance testing.

The workstations shall include automated tools for the configuration management of software and associated hardware. The Contractor shall use this system throughout the Contract term so that configuration is controlled and WMATA`s configuration documentation remains current with the actual equipment configuration.

During the Warranty Period, the Contractor shall update WMATA's NEPP source code and any software development tools to maintain consistency with the software installed in the NEPP equipment and systems. The Contractor shall supply updated software and development tools no less frequently than on succeeding anniversaries of the initial delivery. **CDRL 2-17**

All software source code and software development tools shall be subject to WMATA review and certification. The Contractor shall correct any discrepancies identified during the certification process at the Contractor's expense.

2.3.17.11 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.

The Contractor shall define a single software documentation methodology for the project and require all subcontractors to comply with same. The methodology shall be submitted at CDR for WMATA`s approval. **CDRL 2-18** The Contractor shall provide descriptions to enable WMATA`s design reviewers to understand the documentation methodology.

Software, Specifically for Custom Applications

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.

The Contractor shall develop and submit for approval a Software Quality Assurance Plan (SQAP) in accordance with ANSI/IEEE Standard 730. The scope of this document shall cover the entire software development for the project. It shall describe the responsibilities of the Contractor and the Suppliers. The SQAP shall describe the design activities and documentation required of the Contractor and Suppliers. It shall be submitted and approved soon after the NTP, before the submittal of other documents. The SQAP shall require of the Contractor, as a minimum, the following documents:

- A Software Project Management Plan (SPMP);
- A Software Configuration Management Plan (SCMP) in accordance with ANSI/IEEE Standard 828, including definition of the Software Configuration Items (SCI) within each subsystem;

- A Software Verification and Validation Plan (SVVP) in accordance with ANSI/IEEE Standard 1012. This document shall describe the verification and validation plans related to integration of the subsystems that produce the desired behavior of the complete system. Verification and validation is to be done as early in the development cycle as possible. Whenever possible it shall be done within the subsystem development.

- A Software Verification and Validation Report (SVVR) in accordance with ANSI/IEEE Standard 1012;

- User Documentation as described in ANSII/IEEE Standard 730 Section 3.4.2.5;

- System Functional Description (SFD) for each subsystem presenting the external interfaces, defining the processors in the subsystem, the Software Configuration Items, and the internal interfaces within the subsystem. It shall include a software summary table with a row for each software item in the system including proposed COTS items. Columns shall give the software item name and ID, SRS name and ID, SDD name and ID, and section within the SFD where it is described. Each proposed COTS item must be described in the SFD.

- Software Requirements Traceability Matrix (SRTM);

- Document templates, instructions, and definitions for the suppliers to assure consistent documentation for the entire project.

The Contractor shall assure that the documentation produced provides for the straightforward traceability of requirements of the Technical Specification throughout the design documentation and including the final tests. All documents submitted shall utilize revision bars in the margin and/or underline/strike through to highlight changes from one revision to the next.

After original approval, changes to the software shall be formally submitted for approval by WMATA, prior to implementation of the changes in the source code. The software documentation shall be revised concurrently with software changes. New versions of software must be accompanied by revised, reviewed, and released software documentation.

Software Project Management Plan (SPMP)

The SPMP for both the Contractor and the Suppliers shall conform to IEEE Standard 1058, Software Project Management Plans. It shall include a schedule showing the key tasks defined for the project.

Software Requirements Traceability Matrix (SRTM)

The SRTM shall provide cross-referencing between the requirements of the SRSs and the corresponding sections of the SFD, SDD, and the Software Verification Test Plans. It shall include one table for each SCI and within each table; there shall be a row for each SRS requirement. The first column shall be the unique identifier for the individual requirements defined in the SRS.

Columns 2 to 6 shall be, in order, a short description of the requirement, the reference to the corresponding SFD section, the reference to the SRS section, the reference to the SDD section or sections, and last, the reference or references to the Software Validation test. Since the references are dependent on the version of the documents referenced, the specific versions of all referenced documents must be stated for each table.

All references to documents shall specify the location to a sufficiently specific section of text so the reader easily and unambiguously understands the intention.

Software Documentation Templates

The Contractor shall define a template for each deliverable document. A common general format shall be defined for the title page and the revision history. The title page shall include the Contractor or supplier name, project name, document name, document ID, sign-off names, signatures, and dates, the document version date, and the version ID.

The change history shall show in a table the changes made for each version along with the source of the change such as a review issue, a change, or a meeting action item. Sufficient information must be provided to allow the reader to understand the changes and the reasons for the changes.

2.3.17.12 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 as a part of the NEPP.

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 as identified in Section 19**.**

2.3.18 Operational Smart Media Lists

The NEPP System shall employ a number of different Smart Media lists that shall be stored in and used by the NEPP equipment and system in order to process Smart Media. These lists are described below.

2.3.18.1 Bad Number List

This list is stored by the CDS only and has no size restrictions. This list shall store all known Smart Media identification numbers which cannot be used in the NEPP System. These shall include those defined by WMATA and its partners as well as credit and debit card numbers.

Contractor shall provide information on format, size, refresh frequency and characteristics of the list, as well as the Contractor-provided functionality that shall enable WMATA to actively manage the list, for WMATA review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 2-19**

2.3.18.2 Invalid Smart Media List

This list is created by the CDS extracting selected Smart Media numbers from the Bad Smart Media List based on criteria selected by WMATA. Each NEPP device and station shall locally maintain an invalid media list, which shall consist of entries downloaded from the CDS.

A minimum of 250,000 Smart Media number entries shall be provided with addition or deletion of individual entries possible at the NEPP equipment. Ranges of invalid Smart Media shall be possible, with each range taking no more than three entries in the list. Contractor shall provide information on format, size, and characteristics of the list, as well as the Contractor-provided functionality that shall enable WMATA to actively manage the list, for WMATA review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 2-20**

2.3.18.3 Positive List

This list is created by WMATA and shall be stored by the CDS and the NEPP equipment at the station and device level. This list shall store selected known Smart Media card numbers which can be used in the NEPP System without further verification required. Such Smart Media card numbers shall include those of WMATA Employees and Customers (for which auto-replenish services have been enabled and remain authorized) who continue to satisfy WMATA`s eligibility requirements. These shall include Customers defined by WMATA and its partners. The Positive List shall have a capacity of no less than 250,000 Smart Media numbers, with the ability to allocate additional capacity via the CDS. Contractor shall provide information on format, size, and characteristics of the list, as well as the Contractor-provided functionality that shall enable WMATA to actively manage the list, for WMATA review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 2-21**

2.3.19 Communications

For the NEPP System, all communications and systems interfaces shall be designed to be both robust and secure. Because WMATA anticipates accepting credit and debit cards on devices throughout the NEPP System, all devices, networks, and the entire CDS shall be PCI-DSS and PA-DSS compliant. These requirements apply to all NEPP Devices and are applicable to all forms of communication, including wireless, leased-lines, and WMATA provided Fiber optics (including the link between the Primary and Secondary CDS).

End-to-end encryption shall be provided for all data transferred. "End-to-end encryption" shall mean that the data shall be encrypted at the Payment Processing Terminal (see Section 3) through to the CDS and between the CDS and external financial payment networks.

All connections shall incorporate redundant data paths to ensure reliable systems communications. All communications interfaces shall, to the extent possible, automatically isolate and/or recover from failures and errors. These communications systems shall also be responsible for providing adequate bandwidth to each NEPP device such that there are acceptable levels of data throughput, as defined by WMATA.

2.3.20 Software Updates

All NEPP equipment shall be able to accept software revisions/updates downloaded from the CDS through the applicable data exchange process (as defined in Section 15) at the stations, on vehicles, at bus depots/trolley barns and when communicating to the CDS. All processes for downloading software shall be reviewed and approved by WMATA at PDR. **CDRL 2-22**

When the download is complete and the equipment has acknowledged the receipt of the download, the CDS 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 the NEPP equipment. Incomplete updates shall be retained by the equipment and upon a retry of data upload by the NEPP equipment, the update shall resume from the point of communication interruption.

2.4 Revenue Security and Accountability

Regardless of the payment method, transaction type, Smart Media used, or device involved, all NEPP transactions shall be individually recorded, and PCI DSS-compliant transactional information shall be transmitted to the CDS. Information included in each transaction record shall include all pertinent data to permit a complete reconstruction of the transaction and thorough audits of the NEPP System and contain standard summary-level information needed to consolidate all revenue sources for management reporting. Such audits shall be possible from the unit (device) level to the system level, and all sub-categories between.

NEPP devices that are on-line (that is, they have a continuous high-speed communications link with the CDS) shall seek authorization of all transactions prior to the conclusion of each transaction. Off-line or intermittently on-line NEPP devices shall transmit all recorded (not previously transmitted) transaction records as necessary to support the needs of the System.

As with any modern fare collection system, revenues will occur in tangible form (coins, bills, tokens) and electronic form (such as when a credit/debit card or a machine-readable fare instrument is used). The NEPP System shall employ the highest levels of security for all transaction types to safeguard all revenues.

For coins, bills, and tokens, the NEPP System shall utilize high security locks, vaults, designs, and methods to prevent unauthorized access to cash. From the time that a coin, bill or token is inserted into a piece of NEPP equipment until the time that the cash is reconciled with the WMATA bank deposit, the NEPP software shall track it.

All NEPP devices that collect or store cash shall maintain accurate counts of all stored monies. Upon demand by an authorized user at a CDS workstation and periodically, at an interval predetermined by WMATA, the value of the monies and tokens collected and remaining within the NEPP equipment shall be forwarded to the CDS.

In addition, NEPP devices that collect or store cash shall transmit a message to the CDS when the device reaches a specific value of revenue stored within the device, as well as when a cash storage container is full.

For all electronic forms of revenue and transactions, the NEPP equipment and system elements (including communications) shall be fully compliant with PCI DSS. The NEPP System shall ensure that all transactional data, including but not limited to, that associated with credit card and debit card transactions, are secure and available to only valid users with the proper security clearance.

The location and status of all Smart Media, whether in WMATA`s possession or that of a third party, shall be tracked at all times. The CDS shall centrally manage Smart Media inventory records and controls.

All WMATA Smart Media shall incorporate the highest levels of data security practical. For WMATA Issued Smart Media, all data shall be encrypted using no less that 128-bit encryption keys and DES encryption algorithms.

Smart Media that is incapable of supporting encryption (such as Limited Use Media and magnetic media) shall incorporate non-standard encoding schemes, such as arbitrary-length data fields, data field interleaving (non-contiguous data fields), multiple checksums, and other methods to “scramble” encoded data.

All contactless and wireless communications shall be encrypted using encryption keys that are distinct from those used elsewhere in the system, and shall utilize at least 128-bit keys and DES encryption algorithms.

2.5 Payment Tracking

All Customer transaction records created as a result of fare payments shall contain sufficient information to completely recreate the payment transaction. This information shall include the specific definition of the payment media used including the following types and subtypes of payment media:

- Cash;
- Credit card (by issuer including MasterCard, Visa, American Express, Discover);
- Debit card (VisaDebit, MasterCard Debit, Visa payWave, MasterCard Paypass, Discover Debit);
- Personal check;

- Transitchek; and
- Traveler's Check(s).

All transaction records shall be transferred to the CDS and all information on fare payment shall be retained throughout the report creation process to permit summarization by type and subtype of media (e.g., Visa). This shall require summarization and aggregation of transactions by payment media (e.g., credit card) and subtype of media (e.g., MasterCard). Summary totals shall also be able to be provided by payment media.

Transactions which do not involve payment of any kind by the Customer, including but not limited to, utilization of a WMATA-issued fare credit memo or issuance of Replacement Smart Media, shall be listed as a zero-fare transaction. In the event that Smart Media is issued by WMATA as a replacement for defective Smart or lost Smart Media, the information associated with the Media and/or Account shall be transferred to the new Media and the results of this transaction shall be identified as a revenue transaction with zero dollar ($0). This transaction shall have no impact on any revenue account or revenues received, except for the replacement fee (if any) which shall be identified as revenue.

2.6 Reliability Requirements

Reliability requirements defined in this specification are to be achieved by the end of system reliability testing, as a condition of final acceptance of the system. Reliability requirements are provided in Table 2-1 through Table 2-2. A cycle shall be defined as follows:

A. One complete fare payment (FVD, Sales Devices, HV, etc.) This would include all required passenger actions from commencement of the Smart Media selection through the payment and issue of the Smart Media and providing a receipt as required).

B. One complete passage through the Turnstile aisle, from use of the Smart Media in the free area through exiting the aisle into the paid area.

C. One complete passage from the paid area through the free area using a Turnstile.

D. One complete fare verification at an OBP, including required operator button presses and Smart Media usages.

E. One complete Smart Media validation for the MID when operating as a platform validator.

F. One complete payment of the parking fee. This would include all required passenger actions from commencement of the parking selection through the fee payment (and issue of the receipt as required).

G. The complete printing of one receipt or one report from the HV/Sales Devices printer.

H. The complete payment at the Pay on Foot Machine of the parking fee and the encoding/issue of media for exit.

I. The complete open/close cycle of a parking gate.

J. The complete processing of media for exit using the Exit Reader Unit.

The cycle shall be considered complete with the creation and storage of a transaction record.

The Contractor shall implement a failure reporting mechanism that provides hard evidence that a failure meets one of the conditions identified in Section 19 and is therefore not to be included in reliability calculations.

Table 2-1 – Reliability of Equipment in Mean Cycles Between Failure (MCBF)

Equipment Type	**MCBF (Transactions)**
Fare Vending Device – Full Service	15,000
Fare Vending Device – Cashless	17,500
Fare Vending Device – Exit FVD	19,500
Faregate (overhauled)	25,000
Turnstile (new)	40,000
Faregate (new)	35,000
HV/Sales Devices printer (peripheral)	20,000

Table 2-2 – Reliability of Equipment in Mean Time Between Failure (MTBF)

Equipment Type	MTBF (Hours) (In Service)
Station Wireless Data Network Components	25,000
Centralized Data System	35,040
On-Board Payment Targets	17,520
Sales Device	12,500
Handheld Validator	17,520
Platform Validator	17,520

2.7 Maintainability Requirements

Equipment design shall enable personnel to easily inspect and troubleshoot the NEPP equipment, perform maintenance, and repair or replace components, in order to minimize assembly downtime.

Each item of NEPP equipment and removable assembly shall incorporate a unique serial number affixed in a secure manner. This serial number shall be located in an easily visible location and shall be bar-coded using a standard barcode format.

Automatic diagnostic test routines and test equipment shall be included in all NEPP System equipment to aid technicians in troubleshooting malfunctions. These test routines shall guide technicians through procedures providing the ability to isolate defects to the lowest level replaceable assembly. Location of each test point shall be easily identified by using color coding, number coding (in English), or other equivalent means. All equipment must have clear labels and/or symbols written in English that at a minimum indicate safety, warning, servicing steps, and wiring connections.

Components requiring frequent adjustment shall be conveniently located to facilitate access and adjustment utilizing "fingertip maintenance" techniques, as defined within this document. Electrical and mechanical subassemblies and parts shall be packaged in readily replaceable assemblies.

Assemblies requiring removal for off-site maintenance shall be limited to a weight of forty (40) pounds (US). Assemblies that weigh more than twenty (20) pounds (US) shall be mounted on hinges and/or rollout slides.

Where dissimilar metals meet, protection against galvanic corrosion shall be provided. Removable non-assemblies shall be designed to facilitate exchange or replacement through the use of self-alignment mechanisms, which shall minimize or eliminate adjustments or calibrations.

2.7.1 Preventive Maintenance

For the Preliminary Design Review, the Contractor shall provide, for WMATA review and approval, a matrix that shall clearly delineate the following items: **CDRL 2-23**

A. Preventive Maintenance frequency for all NEPP devices based upon time and transactions;

B. Identification of all tasks to be performed as part of Preventive Maintenance. This identification shall include a brief description of the work, and any parts, materials or components required;

C. Time required to complete each defined preventive maintenance task.

No more than one (1) person shall be required to perform on site preventive maintenance on a single device.

2.7.2 Corrective Maintenance

Corrective Maintenance, which is defined as repairs necessary to return a device to revenue service, shall take no longer on site than defined herein. During the Preliminary Design Review, the Contractor shall provide a matrix or matrices that shall clearly delineate corrective maintenance tasks that can be easily completed on site in the defined time parameters and those that cannot be easily completed on site within the defined time parameters. **CDRL 2-24**

Each identified task shall include a brief description of the work, and the estimated time to complete the task.

Facilities-based equipment shall require no more than 15 minutes of on-site repair time to return the unit to service. On-board NEPP equipment shall require no more than 10 minutes of on-site repair to return the unit to service. To the greatest extent possible, all devices shall utilize standard hardware and components that are commercially available within the United States from multiple suppliers, and designed to maximize interchangeability in both use and maintainability.

No more than one (1) person shall be required to perform on-site remedial maintenance on an individual unit of equipment.

2.7.3 Revenue Servicing

Revenue servicing of FVDs shall not require more than 3 minutes to complete. This time shall be measured from the moment the device door is opened to the moment the door is latched closed and the unit returns to full operational status. Revenue servicing includes the following tasks:

A. Exchange coin vault;

B. Exchange bill vault;

C. Replace/Replenish Smart Media supply;

D. Remove/Replace supplemental coin hoppers;

E. Replenish Smart Media;

F. Complete readiness diagnostic test to verify proper feed of media stock and seating of money devices;

G. Print necessary reports.

Equipment shall be designed to return to operational status only after readiness diagnostics determines that Smart Media stock feeds and money devices are positioned for proper operation, recording of sales, revenue and reporting of the status of cash and supply of Smart Media.

For each FVD, three (3) of each type of cash container incorporated within the FVD shall be provided as part of the NEPP System.

2.8 Nonproprietary Technology

It is the intent of WMATA to procure the NEPP System based on open standards. WMATA understands that the equipment (hardware) and associated internal logic (software and firmware) are largely proprietary to each Contractor, and these items cannot be standardized. However, the following shall be standardized:

A. Media –Contactless media shall be available for purchase by WMATA from multiple sources. Media specifications shall be defined and documented to the extent required allowing WMATA to procure media in a competitive manner. These specifications and associated documentation shall be provided to WMATA and become the property of WMATA at the completion of the initial installation stage. **CDRL 2-25**

B. Media Encoding Schema –The Contractor-developed media encoding schema (e.g., how data is stored on the media, the associated security algorithms/keys, and card/reader authentication schemes and other information, processes and data) shall be defined and documented by the Contractor, and shall become the exclusive property of WMATA. These specifications and associated documentation shall be provided to WMATA become the property of WMATA at System Acceptance. All media encoding schemes used for the Closed Loop, Open Standard financial-based data schemes shall be licensed in perpetuity for use by WMATA. **CDRL 2-26**

C. Equipment and System Interfaces – The equipment and system interfaces shall be defined and documented and shall be licensed to WMATA for use and distribution as WMATA sees fit for NEPP System operation.

D. Interface Protocol – The Contractor shall provide all Interface Protocols and definitions of message structure between all NEPP System equipment at all levels of the system, including communication between all equipment and sub-systems and the CDS and its constituent servers and application processes (both internal to WMATA and external to WMATA such as the inter-bank and non-bank financial clearing systems for transaction settlement.) This information shall be provided to WMATA and become the property of WMATA at System Acceptance. **CDRL 2-27**

The ability for WMATA to share this information with third parties shall not be hindered by any proprietary technologies, licenses or other encumbrances by the Contractor or its subcontractors.

In addition to the above, the system shall be delivered with a user-friendly means of operationally updating fare-processing rules without major software updates to the system. The Contractor shall build the system in a flexible manner to allow WMATA to update at the CDS the fare rules and logic without involvement by the Contractor.

In addition to the specific non-proprietary requirements identified above, the NEPP System shall be designed and developed to enable the incorporation of devices, components and systems supplied by multiple manufacturers. The NEPP System shall not be limited to the utilization of hardware and system components available only from the Contractor.

2.9 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 2-1	Local, state, or national codes, ordinances, statutes, standards, and federal rules and regulations applicable to NEPP System	2.2	PDR	Yes
CDRL 2-2	NEPP System compliance with PCI-DSS	2.2.1	PDR, FDR	No
CDRL 2-3	Existing WMATA systems which are impacted by the NEPP System that are not PCI compliant	2.2.1	PDR	No
CDRL 2-4	NEPP System compliance with PA-DSS	2.2.2	PDR, FDR	No
CDRL 2-5	Additional applicable PCI standards, Information Supplements and Guidelines	2.2.3	NTP + 90 days	No
CDRL 2-6	System Security Plan	2.3.1	NTP + 90 days	Yes
CDRL 2-7	List of all replaceable modules	2.3.5	PDR	Yes
CDRL 2-8	Samples of all safety graphics	2.3.8	PDR, FDR	Yes
CDRL 2-9	Equipment UL certifications	2.3.13	FAT completion	No
CDRL 2-10	Conductor identification	2.3.13.2.6	CDR	Yes
CDRL 2-11	Identification methodology of equipment and components	2.3.13.2.6	CDR	Yes
CDRL 2-12	Versions of third party commercially available software	2.3.17	FDR	Yes
CDRL 2-13	Method for addition, alteration, or deletion of hardware, software, or telecommunications	2.3.17.7	CDR	Yes
CDRL 2-14	Software Configuration Control Plan	2.3.17.7	FDR	Yes
CDRL 2-15	Final software configuration for each NEPP device in electronic format	2.3.17.7	System Acceptance	Yes
CDRL 2-16	Software error code modification methodology	2.3.17.9	PDR, FDR	Yes
CDRL 2-17	Software Development Tools Updates	2.3.17.10	As needed	No
CDRL 2-18	Definition of the software documentation methodology	2.3.17.11	CDR	Yes
CDRL 2-19	Bad number list format, size, refresh frequency and characteristics	2.3.18.1	PDR, FDR	Yes
CDRL 2-20	Invalid smart media list format, size, refresh frequency and characteristics	2.3.18.2	PDR, FDR	Yes
CDRL 2-21	Positive list format, size, refresh frequency and characteristics	2.3.18.3	PDR, FDR	Yes
CDRL 2-22	Processes for downloading software updates	2.3.20	PDR	Yes
CDRL 2-23	Preventive Maintenance Matrix	2.7.1	PDR	Yes

CDRL No.	Description	Section	Due	Approval Required
CDRL 2-24	Corrective Maintenance Matrix	2.7.2	PDR	Yes
CDRL 2-25	Smart Media specifications	2.8.A	Completion of initial installation	No
CDRL 2-26	Smart Media encoding schema	2.8.B	System Acceptance	No
CDRL 2-27	Interface Protocols and definitions of message structure	2.8.D	System Acceptance	No

End of Section 2

Section 3 – Fare Payment Media
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3 FARE PAYMENT MEDIA

The New Electronic Payments Program (NEPP) shall utilize multiple forms of new media for payment of transportation services. This section specifies types of Smart Media to be employed and associated processing and hardware requirements, including:

- Types of Smart Media issued and processed by the NEPP System;
- Smart Media handling module requirements;
- Fares supported within the NEPP System; and
- Smart Media tracking needs.

New media issued by WMATA and WMATA-partners shall primarily be Contactless Smart Media ("Smart Media"), which shall be closed-loop, open standard, account-based Media incorporating electronic memory and contactless communications methods.

WMATA Smart Media (both the contactless and magnetic interfaces) as provided by the Contractor for the NEPP System shall be compliant with applicable standards. With the exception of the NEPP Long-term Smart Card, acceptable technologies for WMATA Smart Media include MasterCard PayPass®, Visa payWave®, American Express ExpressPay®, Discover Zip® or other third-party, standard-based technology approved by WMATA.

WMATA Smart Media shall be provided in three forms (NEPP Long-term Smart Card, NEPP-only, and Private Label) as follows:

- Closed loop NEPP-only Long-term Smart Card Media that is a memory-based card and is intended for use and reload through the WMATA NEPP system and Preferred Vendor Sales locations (see Section 22) only. Accounts for this media shall exist only within the CDS and the Smart Media shall include only WMATA or WMATA approved branding. Usage, Reload and Payment Transactions for this Smart Media shall be processed only within the CDS and NEPP System. A magnetic stripe is not required for this Smart Media. The media shall have a pre-encoded unique 20-digit unalterable serial number encoded on the embedded chip.

- Closed loop Open Standard NEPP-only Media that does not use a Bank Identification Number (BIN) of a U.S. financial institution and is intended for use and reload through the WMATA NEPP system and Preferred Vendor Sales locations (see Section 22) only. Accounts for this media shall exist only within the CDS and the Smart Media shall include only WMATA or WMATA approved branding and not include branding of the underlying financial industry technology or brand. Usage, Reload and Payment Transactions for this Smart Media shall be processed only within the CDS and NEPP System and not on the network of the financial industry. A magnetic stripe is not required for this Smart Media.

- Closed-Loop, Open Standard Private Label Media shall use a Bank Identification Number (BIN) of a U.S. financial institution. The Smart Media shall have WMATA or WMATA approved branding and shall not include branding of the underlying financial industry technology other than that required for accessing an applicable reload network. However, the ability of customers to reload the Smart Media outside of the WMATA NEPP system or Preferred Vendor Sales location (see Section 22) shall be at the sole discretion of WMATA. To ensure that WMATA Smart Media has the widest possible opportunity for Account reload at non-WMATA locations, WMATA requires that this WMATA Smart Media also have a magnetic stripe for reloading purposes only.

All WMATA Smart Media shall be capable of being anonymous or personalized and with or without a photo.

Contractor shall submit the proposed Smart Media technology to WMATA for review at the Conceptual Design Review and approval at the Preliminary Design Review. **CDRL 3-1**

WMATA requires that the Contractor acquire a license and all rights as needed that entitles the NEPP System to utilize and process the Approved acceptable financial industry technology for WMATA Smart Media. This license shall be valid for the life of the NEPP System. The license and all rights associated with license shall be transferred from the Contractor to WMATA upon commencement of full revenue service of the NEPP System. **CDRL 3-2**

The Contractor shall configure the NEPP system to process all acceptable forms of payment and all applicable Smart Media in accordance with applicable standards and applicable requirements of

the U.S. financial services industry. Smart Media not issued by, or compliant with U.S. financial services industry, shall be processed in accordance with any applicable standards and applicable requirements of the Smart Media.

The validity of Smart Media presented for payment of transportation services shall be verified via account information stored in the Central Data System (CDS) as described in Section 4.

Contractor shall provide full information on the validity checking steps performed by the PPT for each fare type for WMATA review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 3-3**

The NEPP System shall accommodate Smart Media in any form that is ISO/IEC-14443 compliant, including NFC-based devices. While it is anticipated that the majority of Smart Media shall be credit card-sized media, the use of key fobs, watches, adhesive labels, mobile phones and any other similar ISO/IEC-14443 compliant devices shall be usable in the NEPP System, as determined by WMATA. The NEPP System shall accommodate and properly process Smart Media with antennas as small as 0.75 square inches.

All types of WMATA Smart Media shall be capable of being provisioned “over-the-air” to mobile devices such as those with NFC-capabilities. The WMATA Smart Media stored on a mobile device shall emulate the functionality for customers using other form factors such as cards.

NEPP System devices shall issue contactless Limited Use Media for short-duration ticketing purposes. The validity of this presented media for transportation services shall be verified via account information stored in the CDS as described in Section 4 in a manner similar to WMATA Smart Media.

The Contractor shall supply new Smart Media to be issued by WMATA and utilized within the NEPP System. All Smart Media shall fully comply with all standards referenced herein except where otherwise specifically identified.

All NEPP System equipment that process fares shall be equipped with Payment Processing Targets (PPTs). The PPTs shall be capable of processing all Smart Media that is accepted by the NEPP System, and shall satisfy all performance requirements defined herein.

NEPP System equipment shall accept Smart Media provided by registered and authorized partner organizations such as local employers, adjoining public transit agencies, universities, etc. The NEPP System shall also accept compatible contactless media that is available to the public from third parties, including Contactless Credit and Debit media**.**

The NEPP System shall initially accommodate all fares as presently provided by WMATA (See Exhibit 1), subject to on-going change of the values associated with these fares as well as fare products due to fare and policy changes by WMATA and the Regional Partners.

3.1 Smart Media Modules

The NEPP System equipment shall incorporate Smart Media modules as required to satisfy WMATA's fare policies. The Contractor shall provide certification documents for the PPT and Smart Media Dispenser Module from a qualified, independent third party testing firm as confirmation that the devices are fully compliant with all applicable standards and requirements. These certifications shall be submitted for WMATA review and approval at the Preliminary Design Review. **CDRL 3-4**

Similarly, the Contractor shall provide certificates during the Preliminary Design Review from a qualified, independent third party testing firm confirming that the WMATA Smart Media meets all required ISO/IEC-14443 and open standard payment platform requirements. **CDRL 3-5**

3.1.1 Payment Processing Targets

NEPP System equipment shall incorporate Payment Processing Targets (PPTs) to electronically read and, when necessary, modify data encoded on Smart Media using a contactless interface. These PPTs shall be provided by a manufacturer which was identified as one of the top twenty (20) suppliers of POS terminals as identified in the 2010 (or later) Nilson Report. Software modifications for the processing of the Smart Media shall be performed by the PPT supplier.

The PPT within all device types shall be the same component, hardware swappable with any PPT within the NEPP. The PPTs shall:

- Fully comply with the most recent version of the ISO/IEC-14443 standard;

- Accept Smart Media using both ISO/IEC-14443 Type A and Type B communications signal interfaces;

- Incorporate hardware certified as fully compliant with relevant portions of the most recent version of the Europay/MasterCard /Visa (EMV) Integrated Circuit Card Specifications for Payment Systems Standards and EMV Contactless Specifications for Payment Systems. PPTs shall be certified compliant as EMV Level 1 and Level 2 terminals.

- Incorporate hardware which can fully accommodate the EMV Entry Point standard for contact and contactless payment media;

- Include the necessary hardware and embedded firmware to accept and keep secure the encryption keys required to process (encrypt and de-encrypt) data read from and communicated to the Smart Media;

- Incorporate the necessary software to process all Smart Media to be accepted by the NEPP System, including WMATA Smart Media, Partner-Issued Smart Media, Limited Use Media, Contactless Credit/Debit Media, and PIV Media;

- Securely process PIV media.

All compliant Smart Media shall be readable when presented to a PPT when held parallel to the PPT antenna, and with the center of the Smart Media antenna anywhere within an imaginary cylinder that is at least three inches in diameter and at least one inch high, centered over the PPT antenna. When compliant Smart Media are within this specified read range, the PPT shall successfully read all Smart Media not less that 99.995% of the time. All data read from the Smart Media shall be properly transferred and stored without any data loss or corruption.

When WMATA elects to accept EMV-based Smart Media, the Contractor shall:

- Provide certification documents for the PPT from qualified, independent third party testing firm confirming that the PPT is fully compliant with EMV Contactless Specifications for Payment Systems requirements. The certification documents shall be submitted for WMATA review and approval not less than sixty (60) days prior to activation of the EMV requirements and not more than ten (10) days after certification has been completed. **CDRL 3-6**

- Be responsible for obtaining timely EMV recertification for all NEPP System elements as software changes are made which require recertification prior to warranty completion. **CDRL 3-7**

- Verify that all elements of the NEPP System have been recertified as necessary to verify full compliance with EMV Contactless Specifications for Payment Systems at the completion of the warranty and prior to responsibility for the NEPP System transferring to WMATA. **CDRL 3-8**

The PPT shall be modularly upgradeable so that it does not need to be replaced in its entirety to increase memory capacity, to upgrade processing performance, to provide for additional Smart Media functionality or to maintain compatibility with ISO/IEC-14443 standards as they develop.

In addition to the above requirements, PPTs incorporated within any configuration of an FVD shall also be able to process the WMATA SmarTrip cards in the same manner as at present. This feature shall be able to be activated and deactivated, based on configuration parameters modifiable by SEPTA.

Full information on the PPT hardware and software shall be provided for WMATA review and approval at CDR and PDR. **CDRL 3-9**

3.1.2 Smart Media Dispenser Modules

As specified herein, some NEPP field equipment shall dispense WMATA Smart Media.

Smart Media Dispenser Modules shall read data from the Smart Media as required to satisfy all relevant functional requirements stated herein. The WMATA Smart Media information shall then be forwarded to the CDS where an account shall be automatically created. All WMATA and Partner Issued Smart Media shall be anonymous unless the Smart Media is registered by the Customer.

The Smart Media Dispenser Modules shall comply with the most recent version of ISO/IEC-14443, and be capable of processing both Type A and Type B communications signal interfaces as required to meet WMATA functional needs.

3.2 Media

The Contractor shall supply the following Smart Media to be issued and processed by the NEPP System:

- WMATA Smart Media, shall be designed for repeated use over a minimum expected life of three years. This Smart Media shall support customer processing for account-based Smart Media for pre-funded value, post-funded ("pay as you ride") value (account-based only), fixed period passes, pre-funded and post-funded (account-based only) rides/trips, floating period passes, embedded transfer privileges, and any combinations of these requirements.

- Limited Use Media, which shall be used to support short-term fares. To optimize system utilization and address the needs of infrequent riders, WMATA must have the option to dispense media to customers without WMATA Smart Media. To support this, the NEPP will facilitate the deployment of Limited Use Media (LUM) for low value, short-term products such as single trip tickets or day passes. LUM will be account-based media, similar to the other media accepted by the NEPP.

In addition to the above, the NEPP System shall, at designated locations, with designated devices, accept cash, credit media, debit media and other Smart Media for fare payment, including adding fare products to Smart Media accounts. Fare Media, as used within these requirements, shall mean the following:

- WMATA Smart Media (see Section 3.2.2);
- Limited Use Media (see Section 3.2.3);
- Partner-Issued Smart Media (see Section 3.2.4);
- Bank-Issued Media (see Section 3.2.5); and
- Personal Identity Verification (PIV) Card (see Section 3.2.6).

Neither cash nor tokens shall be accepted for fare payment by the turnstiles or faregates.

- In general, no data shall be written or re-written to the WMATA Smart Media by any item of NEPP Equipment with the following exceptions subject to approval by WMATA:
- In the event that an EMV-enabled card is provided as WMATA Smart Media, data required for EMV processing may be written;
- In the event that EMV credit cards are to be processed by the NEPP System, data required for EMV processing may be written;
- In the event the financial services industry establishes a standard or operating regulation that permits such for the purposes of processing open standard fare media in the transit environment; other exception as approved by WMATA.

3.2.1 Security

Smart Media shall incorporate comprehensive security schemes to ensure that the Smart Media cannot be cloned or deciphered by an unauthorized individual through the use of standard, third party smart card reading devices, “brute force” or other methods known at the time of the start of the Final Design Review.

The final security measures proposed to be in place for the initial implementation phase shall be submitted for WMATA review and approval at the Final Design Review. **CDRL 3-10** Until the warranty has expired, the Contractor shall redesign and modify any or all elements of the NEPP System to ensure its ability to withstand all attempted security breaches without loss of any NEPP System or Smart Media security.

3.2.2 WMATA Smart Media

WMATA Smart Media shall incorporate a unique card number for the purpose of establishing a customer’s account within the CDS. For applicable media, configuration and processing of the unique card number shall be in compliance with the license(s) provided in accordance with the NEPP Contract.

If the U.S. Financial Services industry adopts a standard for contactless EMV media, the Contractor shall provide a transition plan to transition to contactless EMV-compliant WMATA smart media.

Distribution of WMATA Smart Media shall be through multiple channels, including:

- FVDs;
- WMATA Customer Service Centers;
- Third-party locations;
- NEPP Customer Support Center;
- Internet; and
- Employers.

WMATA shall have capability to decide which form or forms of WMATA Smart Media (Long-term, NEPP-only and Private Label) are available at each distribution channel.

All WMTA Smart Media shall be in accordance with the applicable licensing agreement entered into for the NEPP System.

WMATA Smart Media shall be ISO/IEC-14443 compliant, either Type A or Type B. The NEPP System shall support any Smart Media form factors, and devices (such as stickers, key fobs, cell phones, etc.) so long as the Smart Media complies with all relevant parts of the ISO/IEC-14443 standard.

Contractor shall provide quantities of not less than five (5) other types of ISO/IEC 14443 Smart Media (e.g., memory cards, building access cards, etc.) which can be processed by and programmed to be used in the NEPP System. These other Smart Media shall be tested to verify that they can be processed properly by the NEPP System. Additionally, WMATA Smart Media shall:

- Be a memory card or a microprocessor-based card of current manufacture.
- Where specified, incorporate a magnetic stripe compliant with ISO 7811 parts 1 through 6.
- Employ sophisticated dynamic encryption methods, which shall employ triple Digital Encryption Standard (3DES) or Advanced Encryption Standard (AES) algorithms.

- When in an ISO/IEC-7810 compliant form, WMATA Smart Media shall be a card constructed of laminated layers, and at least the central layer shall be composed of Polyester (PET) plastic. A thin clear plastic layer laminated to the card shall protect all pre-printed graphics. All Smart Media in standard card form shall comply with most recent versions of ISO/IEC-10373 and ANSI INCITS 322 for durability.

- Have a pre-encoded unique manufacturer serial number encoded on the embedded chip. These serial numbers shall be printed on the Smart Media and unalterable.

Contractor shall provide a plan outlining all details regarding each type of media that is to be provided as part of this contract, including how each shall be processed. This shall include (but not be limited to) full technical details and specifications, details regarding shape and form factor, as well manufacturer cut-sheets. This plan shall be subject to WMATA review at Conceptual Design Review and approval at Final Design Review. **CDRL 3-11**

Deliveries of WMATA Smart Media shall be made under controlled conditions, with the WMATA Smart Media packaged in batches of 300. The packaging for each batch shall be sequentially numbered and bar coded. Additionally, each WMATA Smart Media instrument shall have a unique, sequential inventory control number assigned to it at the time of manufacture. All Smart Media, even those that are to be otherwise blank, shall have a unique sequential serial number and a security code of at least four digits printed and engraved on one side of the Smart Media. The security code shall be random, the last digits of the unique serial number encoded on the embedded chip or based on an algorithm using information stored on the Smart Media.

The proposed approach for development and application of serial numbers, and associated Media inventory control mechanism, shall be subject to WMATA review at Conceptual Design Review and approval at Final Design Review. **CDRL 3-12.**

The Contractor shall provide an electronic file containing the inventory control numbers and associated serial numbers of all Smart Media in each batch. If the security control code is random, the electronic file shall also contain the security control code assigned to each Smart Media. The CDS shall include a function to import these files into the NEPP database via the Smart Media Manager (see Section 16). As WMATA Smart Media are distributed, authorized WMATA employees shall be able to change the inventory status of each batch.

Excluding the NEPP System Contractor, WMATA Smart Media shall be available from no less than two manufacturers located within the United States. WMATA shall retain all rights to the marketing and logo for the Smart Media and any materials distributed with the Smart Media, such as sleeves.

In addition to the sequential serial number, all WMATA Smart Media shall be delivered with encoding on the embedded chip random access memory and on the magnetic stripe that is in accordance with the licensing agreement entered into for the Smart Media. The proposed magnetic and memory data to be encoded on the WMATA Smart Media shall be subject to WMATA review at Preliminary Design Review and approval at Final Design Review. **CDRL 3-13.**

WMATA Smart Media shall be supplied in a variety of designs and color schemes as provided by WMATA, as well as those that are blank on at least one side to accommodate custom printing.

3.2.3 Limited Use Media

Limited Use Media will be issued for specific short-term use by WMATA, participating Agencies or partner institutions for such uses including, but not limited to transfers, single rides, day pass, tourist/convention pass and low-value e-purse. These media shall have the following characteristics:

- Low-cost, disposable contactless smart cards issued for limited short-term usage without replenishment
- Compliant with INCTIS/ANSI-410
- Support account-based platform for processing fare payments
- Employ encryption methods utilizing either Triple Digital Encryption Standard (TDES) or Advanced Encryption Standard (AES) algorithms or other method as approved by WMATA
- Have a pre-encoded unique 20-digit unalterable serial number encoded on the embedded chip

The LUM shall have the credit card dimensions specified by ISO/IEC-7810, with the exception of thickness, which shall be as thin as possible while providing sufficient durability.

Contractor shall provide information on all details regarding each type of LUM that is to be provided for the NEPP. This shall include (but

not be limited to) full technical details and specifications, details regarding shape and form factor, as well manufacturer cut-sheets. This plan shall be subject to WMATA review at Conceptual Design Review and approval at Final Design Review. **CDRL 3-14**

Deliveries of LUM shall be made under controlled conditions.

The Contractor shall supply paper-based contactless LUM in two forms:

- Rolls or fan-fold stacks, with a minimum of 2,000 limited use media per roll or stack. The FVD shall issue these media; validity and other information shall be printed on the document at the time of issue using direct thermal technology. The serial number shall be unalterable, shall be pre-printed on each card and shall be the same as the encoded serial number. The non-thermal side of the media stock shall include pre-printed information and graphics; these designs shall be provided by WMATA.

- Individual die-cut media in pre-bundled batches of 100. These shall be pre-printed with WMATA-approved graphics, and shall require no additional printing applied upon issuance. The serial number shall be unalterable, and shall be pre-printed on each card.

The packaging for each roll/stack and batch shall be sequentially numbered and bar coded. Additionally, each LUM instrument shall have a unique, sequential inventory control number assigned to it at the time of manufacture. All LUM, even those that are to be otherwise blank, shall have a unique sequential inventory control number printed on one side of the LUM adjacent to the serial number.

The Contractor shall provide an electronic file containing the inventory control numbers and associated serial numbers of all LUM in each batch. The CDS shall include a function to import these files into the NEPP database via the Smart Media Manager (see Section 19). As LUM are distributed, authorized WMATA employees shall be able to change the inventory status of each batch.

Excluding the NEPP System Contractor, LUM shall be available from no less than two manufacturers located within the United States. WMATA shall retain all rights to the marketing and logo for the Media and any materials distributed with the LUM, such as sleeves.

The proposed data to be encoded on the WMATA LUM shall be subject to WMATA review at Conceptual Design Review and approval at Final Design Review. **CDRL 3-15**

WMATA LUM shall be supplied in a variety of designs and color schemes as provided by WMATA, as well as those that are blank on at least one side to accommodate custom printing.

3.2.4 Partner-Issued Smart Media

Owners of ISO/IEC-14443 compliant Smart Media issued by organizations with contractual agreements with WMATA may register their Smart Media with WMATA, and thereafter use a linked account on the CDS for payment and replenishment purposes. Such Smart Media (such as those issued by adjoining public transit agencies and the Federal Government), shall be accepted by NEPP devices for boarding or entry only after the NEPP device receives confirmation from the CDS that the Smart Media is linked to a valid account according to fare policies established by WMATA.

Partner Smart Media shall be read-only Smart Media, and the NEPP devices shall also utilize passback control (as identified in Section 7.5.4) as necessary to ascertain the validity of Partner Smart Media for boarding or entry.

3.2.5 Bank-Issued Media

Boarding or entry/exit shall be granted to bank-issued contactless credit and contactless signature debit media users only after the NEPP device has received authorization for the transaction according to the business rules and fare policies established by WMATA. It shall not be possible to utilize bank-issued magnetic media for boarding or entry/exit purposes.

3.2.6 PIV Media

The NEPP System shall securely process properly registered PIV cards (which includes all variations of PIV-compliant media such as PIV, PIV-I, etc.) as Smart Media. PIV cards shall be able to be processed as both:

- A read-only credential (similar to Partner Issued Smart Media);
- A credential conforming to updated PIV requirements, including read/write capability, if applicable.

Boarding or entry/exit shall be granted to PIV card-users only after the NEPP device has received authorization for the transaction according to the business rules and fare policies established by WMATA. As the PIV card security and other strategies are revised, the NEPP shall accommodate these processing differences.

The NEPP shall utilize industry requirements and/or standards to uniquely identify a PIV card.

The NEPP shall support card management by linking the PIV card to its issuer and NEPP account through a trusted relationship using PKI technology. Secure registration of PIV cards shall be available through both a bulk data transfer from an employer/issuer/funding source and via secure self-service web functionality in a manner that captures the required data elements from the PIV card. In the self-service registration process, the NEPP shall rely upon the Customer's personal smart card reader to facilitate the capturing of required data elements from the PIV card.

PIV card accounts shall permit funding using transit benefits, other payment mechanisms as stated in Section 4, or both. All PIV card-based accounts shall be capable of having their accounts upgraded to add a transit benefit funding method at any time.

Recurring Transit Benefit funding shall be enabled for PIV-based accounts through a secure bulk data transfer from an authorized benefits administrator.

The NEPP shall handle temporary or permanent suspension of the use of a PIV card within the NEPP, whether suspended by either the issuer or the Customer.

The NEPP shall leverage all applicable Open Credential Standards for PIV technology and shall utilize Generic ID-Card Command Set-compliant profiles per ANSI/INCITS standards (or equivalent requirements) to ensure satisfactory transaction speed performance on the NEPP.

3.2.7 Additional Media

Additional types of smart media shall be able to be added to the NEPP and provide for proper CDS configuration at the CDS.

3.3 NEPP Transactions and Speeds

Within the NEPP, each transaction message shall be uniquely identified to permit full accountability and auditability of all activity. This unique identifier shall include a sequential number of not less than six (6) digits, the PTT number, date, time, and other necessary information to provide uniqueness within the NEPP.

Transaction speed is of the utmost importance to a successful public transit payment system. The NEPP System shall conduct usage transactions within the maximum times specified below.

Table 3-1 - Maximum Transaction Times

Transaction Type	Maximum TRANSACTION TIME at Each Device	
	Turnstile, Faregate, OBPT, and PV	HVSD and FVD
Use WMATA Smart Media for Boarding or Entry/Exit	300 ms	750 ms
Use Partner Contactless Smart Media for Boarding or Entry Exit	300 ms	850 ms
Use Bank Contactless Credit Media for Boarding or Entry/Exit	300 ms	850 ms

Transaction times shall be measured as defined in this Technical Specification and shall exclude Orphan Mode transactions (Section 4), and timing commences when the Smart Media enters the operating field of the PTT.

Processing shall include all processing steps until Smart Media processing is complete and shall include, but not be limited to, the following steps:

- Media authentication, transaction authorization, and all other automated steps necessary to conduct transactions.
- Where lists are retained (either at the device or the CDS) of Smart Media to be rejected (e.g. Invalid Smart Media List, Bad Number List, etc.), or accepted (e.g., Positive Number List), all transaction times shall be measured with these lists at their required maximum capacities.
- Velocity checks.

- All times identified in Table 3-1 - Maximum Transaction Times, include a time of not more than 50ms for the “barrier open” message to be sent and an acknowledgement received by the Electronic Control Unit.

  - Where a barrier mechanism is utilized to facilitate entry to or exit from WMATA’s transportation system (such as at the Faregate/Turnstile or ADA Faregate), the transaction time is considered complete when the turnstile/faregate release is activated and the customer receives a visual and audio indication of successful transaction completion.

  - Where an automated non-barrier mechanism is utilized to facilitate entry to WMATA’s transportation system (such as at the OBPT, HVSD or PV), the transaction time is considered complete when the customer or conductor receives a visual and audio indication of successful or unsuccessful transaction.

- Completion of writing to the Smart Media (where required).

At the conclusion of each usage transaction, the NEPP device shall convey to the customer, audibly and visually, the success or failure of the transaction, including any failure reasons, and the status of the transactions.

PPTs shall include settable parameters that would allow for all transactions to have a consistent transaction time (e.g. transactions are completed at 550ms even if a authorization or denial response is received in a shorter time frame). It is assumed that, if used, this parameter shall equal the Orphan Mode time.

Each transaction at a PPT shall also include comparison of the WMATA Smart Media to an Invalid Smart Media List (see Section 2.3.16) to determine if the media should be rejected and reported.

When Invalid Smart Media item is identified, the CDS shall reject the Smart Media. When NEPP equipment is communicating in an on-line manner with the CDS, the Bad Number List on the CDS shall be used and when such communication is not available for a WMATA definable period of time, the Invalid Smart Media List resident in the NEPP device shall be used and the list shall be checked at the device and station level.

The Positive Number List shall also be used to verify the validity of Smart Media, as applicable.

Commercially available open standard end-to-end encryption shall be provided for the processing of all Smart Media. All data transmitted between the sales devices and the CDS from time of presentation to the PPT to response regarding validity of the Smart Media shall be encrypted. Method of end-to-end encryption shall be provided by the Contractor to WMATA for review at the Conceptual Design Review and for WMATA approval at the Final Design Review. **CDRL 3-16**

3.4 Smart Media Traceability

Transactional information shall be automatically sent to the CDS upon issuance of any WMATA Smart Media at an NEPP device. The CDS shall use this data to activate the associated account so that the Smart Media is immediately usable upon purchase. The CDS shall also use transaction data for new Smart Media purchases for inventory status tracking and fraud mitigation purposes. The proposed set of transactional information shall be subject to WMATA review at Conceptual Design Review and approval at Final Design Review. **CDRL 3-17**

All Smart Media shall be tracked throughout the NEPP System. To detect fraudulent media use, the NEPP System shall review all transactions on a daily basis, checking for the following conditions:

- The same Smart Media identification number at different locations within too short of time span. This routine shall compare the time between transactions with a minimum travel time look-up table.
- A Smart Media identification number which has not been issued by or registered with the NEPP System;
- Smart Media whose use has exceeded the total issued/added value;
- Smart Media attempted to be used in the NEPP but for which there is no valid account;
- Excessive use of Smart Media, based on a WMATA-defined number of instances over a WMATA-defined period of time;
- Invalid accounts.

Transactions and associated Smart Media found to be in violation of one of the above conditions shall be immediately reported to a WMATA-identified user terminal while also separately storing these transaction records by the CDS for review by an analyst. In addition, each day as a minimum a report shall be generated, in electronic format, and forwarded to a second WMATA-identified user/location.

During the review, the analyst shall be able to add the Smart Media identification number to the Invalid Smart Media List, review prior media history for that Smart Media identification number, remove the Smart Media identification number from the violation list, or defer decision on the violation.

Regardless of action taken by the analyst, the suspected violation, Smart Media identification number, history of usage and action taken shall be archived for future review. The Contractor shall provide a detailed description of the Smart Media tracking system at the CDR for WMATA review and at the Final Design Review for WMATA approval. **CDRL 3-18**

WMATA shall be able to select specific types of Smart Media to be tracked in order to provide for the most efficient operation. This would permit certain fare types to be omitted, such as transfers and single trip media. Initially, all Smart Media shall be tracked throughout the NEPP, including those purchased by WMATA but not issued to Customers.

3.5 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 3-1	Smart Media Technology	3.0	CDR, PDR	Yes
CDRL 3-2	Licenses for the approved acceptable technology for WMATA	3.0	at Final Acceptance	No
CDRL 3-3	Validity checking steps performed by the PPT for each fare type	3.0	PDR, FDR	Yes
CDRL 3-4	Certification documents for the PPT and Smart Media Dispenser Module	3.1	PDR	Yes
CDRL 3-5	Certificates confirming that the WMATA Smart Media meets ISO/IEC-14443 and open standard payment platform requirements	3.1	PDR	Yes
CDRL 3-6	Certification of fully compliant with EMV Contactless Specifications	3.1.1	10 days after certification completed	No
CDRL 3-7	EMV recertification	3.1.1	When software	No

CDRL No.	Description	Section	Due	Approval Required
			changes (prior to warranty completion)	
CDRL 3-8	EMV recertification	3.1.1	As needed (prior to warranty completion)	No
CDRL 3-9	PPT hardware and software information	3.1.1	CDR, PDR	Yes
CDRL 3-10	Smart Media security measures	3.2.1	FDR	Yes
CDRL 3-11	Description of processing for each type of media	3.2.2	CDR, FDR	Yes
CDRL 3-12	Approach for development and application of serial numbers,	3.2.2	CDR, FDR	Yes
CDRL 3-13	Magnetic and microprocessor data to be encoded and stored on the Smart Media	3.2.2	PDR, FDR	Yes
CDRL 3-14	Detailed information on all details regarding each type of LUM provided	3.2.3	CDR, FDR	Yes
CDRL 3-15	Data to be encoded on the WMATA LUM	3.2.3	CDR, FDR	Yes
CDRL 3-16	Method of commercially available, open standard end-to-end encryption	3.3	CDR, FDR	Yes
CDRL 3-17	Set of transactional information proposed for Smart Media traceability	3.4	CDR, FDR	Yes
CDRL 3-18	Detailed description of the Smart Media tracking system	3.4	FDR	Yes

End of Section 3

Section 4 – Payment Transaction Processing
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4 PAYMENT TRANSACTION PROCESSING

Smart Media employed in the NEPP System shall operate in an account-based manner and conform to open standards in processing WMATA fare payments. The NEPP System shall accept and process WMATA Smart Media and Partner Issued Smart Media as well as Contactless Credit and Debit Smart Media issued by the financial services and payments industries, and other media as identified in Section 3. This Section defines:

- Processing of the Smart Media to verify its authenticity and validity;
- Calculation of the fare required for the trip, based upon the trip segments collected;
- Collection of payments associated with fares calculated and Smart Media purchases; and
- Forms of payment accepted by the NEPP System.

Based on authenticity and validity verifications, appropriate charges shall be made to NEPP System Smart Media accounts and credit/debit media accounts. Customers shall then be permitted access to WMATA transportation services. For some transit services, such as the WMATA Metrorail system, fares shall be calculated when the Customer exits the paid area using a faregate/turnstile. Ride history shall be used to calculate appropriate fares (e.g. eligibility for transfers) based on business rules as defined at the Central Data System (CDS).

Smart Media as identified in Section 3 shall be processed, authorized, and settled by the NEPP System. The CDS, utilzing the Bank Card Processing Server (BCPS), shall provide for communication with financial institutions (banks and/or clearinghouses) for the purposes of obtaining authorization to complete a transaction with a credit card or debit card, or to load value to an account within the CDS.

The CDS shall include all application software and all interfaces shall be fully compliant with the PCI DSS and PA DSS standards as identified in Sections 2 and 4.4.1.

End-to-end encryption shall be provided for the processing of all Smart Media. All data transmitted between the sales devices and the CDS from time of presentation to the Payment Processing Target (PPT) to response regarding validity of the Smart Media shall be encrypted.

4.1 Payment Transaction Processing

4.1.1 General

Data shall be read by the PPTs incorporated into the NEPP equipment and forwarded in real-time over the communications networks described in Section 15 to the CDS as described in Section 16. The following shall be performed by the CDS in an account-based manner:

- All calculations of fares and payments due;
- All verifications of Smart Media validity; and
- All authorizations of the Smart Media for access to WMATA transportation services.

All payment transactions using WMATA Smart Media, Partner Smart Media, and third-party Smart Media shall be processed, authorized, and settled by the NEPP in accordance with the applicable requirements and applicable standards of the Media.

All Smart Media shall either be processed as Pay-As-You-Go trips or Pre-Paid trips. The complete set of applicable criteria shall be applied to each trip in determining the final cost of each trip, or a sequence of related trips as defined by WMATA, that are taken with an individual piece of Smart Media that is associated with a single transit account.

- Pay-As-You-Go – payment via a charge to a central account at a financial institution or stored at the CDS;
- Pre-Paid – a pass has been pre-purchased or funds have been prepaid specifically for transit usage and are stored in the Smart Media account on the CDS.

Acceptable forms of payment within the NEPP include:

- Cash;
- Personal Check;
- Smart Media;
- Major credit, debit and prepaid brands (e.g. American Express, Discover, MasterCard, Visa, etc.);
- ACH (direct deduction from the user's bank or checking account);
- Payment by Employer-sponsored account or SmartBenefits Account. (These payments are for Employer Subsidized accounts and related Smart Media only). Accounts must be able to support rollover of unused funds as well as nonrollover of funds based on selectable parameters for individual accounts and groups of accounts.
- PayPal, Facebook, and other emerging non-bank institutions;
- Payment by third party sponsors such as schools or social services.

Fare media shall be capable of having multiple funding accounts at the CDS, including but not limited to:

- Pre-tax benefit account for transit;
- Pre-tax benefit account for parking;
- Other applicable pre-tax benefits accounts;
- General transit account;
- General parking account;
- Post-tax general stored value account (not directed to either parking or transit).

For example, a media with multiple funding accounts may draw down from a pre-tax account initially and then access a general transit account for remaining rides until the pre-tax account is replenished. The order of priority for accessing accounts for rides shall be settable.

The NEPP System shall have the flexibility to accept alternative payment methods, such as "branded-wallets" which ultimately rely on credit and debit for Electronic Transfers of Funds (EFT), and "non-bank network solutions" that rely on the Automated Clearing House (ACH) for EFT or PayPal. Sales by all NEPP equipment shall be summarized based on payment methodology for all Customer purchases. These summaries shall be based on the method of payment and the following summaries shall be provided as a minimum, as applicable by equipment type:

- Credit card – by card brand (e.g. MasterCard, Visa, American Express, Discover);
- Debit card – by card brand (e.g. MasterCard, Visa, American Express, Discover);
- Cash/token;
- Personal check;
- SmartBenefits;
- Non-bank network solutions (by network).

4.1.2 Smart Media Purchase

An account shall be created in the CDS when each item of Smart Media is issued.

- When WMATA Smart Media is purchased at NEPP equipment, the CDS shall create an account and associate the account with the Smart Media dispensed. Transaction processing shall be completed in real time, such that once the transaction is completed the Customer may immediately use the Smart Media for payment of transportation-related services at any PPT in the NEPP system.
- When a WMATA or Partner Smart Media account is replenished at NEPP equipment, over the Internet, or through any WMATA-approved account replenishment location, the CDS shall update the account with the purchase information. Transaction processing shall be completed in real time, such that once the transaction is completed the Customer may immediately use the Smart Media for payment of transportation-related services at any PPT in the NEPP system.

4.1.3 Bankcard Processing

4.1.3.1 General

Valid credit cards and debit cards issued by financial institutions shall be accepted for the payment of fares. These payment transactions shall be processed, authorized, settled and accounted for through the requisite NEPP network servers back to the CDS. The CDS, via the BCPS, shall handle all interfacing necessary for verification of bankcard transactions with clearing institutions selected by WMATA. The CDS, including all application software and interfaces, shall be fully compliant with PCI standards in effect at the time of Final Design Review approval as identified in Section 4.4.1.

The Contractor shall be responsible for execution of all technical and procedural steps to comply with processing requirements for bankcard and open payment processing. This includes, but is not limited to applicable requirements of card associations, providers of merchant services, and issuing financial institutions and other certified issuers of open payment media and devices.

The Contractor shall be responsible for development, testing, certification and maintenance of the interface connection between the BCPS to each card clearinghouse. The Contractor shall also provide all associated software and hardware for purposes of encrypting and transmitting the required data for determination of card validity and fund availability for approving (or rejecting) bank card transactions initiated at all NEPP equipment. Maintenance of the interface connection shall include but not be limited to any upgrades or modifications required to maintain compliance with financial industry rules and regulations.

The communications interface between the BCPS and the clearing house(s) shall utilize a transparent TCP/IP protocol, with a dedicated IP address and TCP/IP port. The Contractor's interface shall provide for an approved commercially available hardware encryption solution. Bankcard transactions shall be processed, authorized, settled, and accounted for through the BCPS and its data communications facility, utilizing the services of one or more card clearing institutions.

Software resident on the system to accommodate the electronic payment type shall conform to applicable ABA, ISO/IEC, Federal Regulations (including Federal Reserve Board Regulations “E” and “Z”), and standards for electronic payment processing. All devices and systems that process financial payment cards shall adhere to the applicable requirements of the financial services industry.

The NEPP System shall be capable of simultaneously processing bankcard transactions from all NEPP devices and to the associated bankcard clearing institutions. The system shall be sized and configured such that the length of time to completely process a transaction does not under normal conditions exceed the maximum time as identified in Section 3, including the time for network traffic. The CDS shall monitor, record, and report on the time the card is read, the time the CDS receives the request for authorization, and the time at which authorization is communicated to the customer to oversee NEPP System compliance with this requirement.

All parameter settings shall be table driven. Tables governing velocity checks for debit cards, credit cards and other card types shall function independently.

NEPP devices shall be capable of performing local Bank Identification Number (BIN) management via table downloads from the CDS.

When processing bankcards, the CDS shall verify that authorization requests are received only from valid devices and terminals and provide the capability to transmit lists of valid device and terminal IDs to the clearinghouse(s) on a recurring or as needed basis.

The NEPP System shall support the logging, storage, backup, and retrieval of information regarding such data transmissions, including timing of the transmission, data transmitted, and status of the transmission, for all data transfers, including individual transactions and settlement files.

Contractor shall furnish documentation at the Conceptual Design Review, Preliminary Design Review and Final Design Review to provide full details for bankcard processing parameters, including suggested settings and rationale. **CDRL 4-1**

4.1.3.2 Credit Card Processing

The CDS shall serve as the central processor for Customer purchases that have credit cards as the payment medium. Valid credit card data shall be passed from the NEPP equipment through the CDS to a clearinghouse for transaction approval.

Software resident on the CDS to accommodate credit and debit card payments shall conform to applicable ISO/IEC, and federal standards for this kind of transaction.

Credit cards used for fare purchases shall be compared to the Bad Number List to limit WMATA exposure to fraud. Velocity checks shall be performed in addition to the other checks and verifications performed, for each item of Smart Media processed. These checks shall be performed within the transaction times identified in Section 3.

Where possible, credit card transactions shall accommodate the use of address and/or zip code verification. Address and zip code verification shall be parameter-based including the ability to turn on or off such verification by device type. Other parameters shall include, but not be limited to, the ability to exclude specific cards (by BIN) from such processing by:

- Device type;
- Card product type (i.e. credit, prepaid, etc.);
- Brand (i.e. American Express, Discover, etc.);
- Cards issued outside of the U.S.

To the extent pretax benefit cards can be identified by value stored on the card magnetic stripe or chip, a parameter should allow for such cards also to be exempted. WMATA should also be able to manually add or remove specific BINs to/from the exclusion list.

Customers using cards excluded from such processing should not be prompted to enter an address or zip code.

The zip code and address processing should be table driven, allowing for specific decisions (i.e. complete transaction or cancel purchase attempt) based on specific response codes for each brand.

A real-time reversal shall be sent to reverse an approved authorization if the purchase attempt was canceled by the System based on the address/zip verification response code.

Internet transactions shall also include the Card Verification Value (CVV) and other security features (such as MasterCard SecureCode or equivalent) as provided for by the credit card brands.

Certain transaction types, such as usages for payment of entry or boarding, shall not require address or zip code verification, as approved by WMATA.In addition to standard bank authorization processing, the Contractor shall enable the CDS to control acceptance of credit cards based on criteria typically used in merchant acceptance of bank cards. These controls typically take the form of velocity checks in which data on historical usage are compared to the current transaction being requested at the point of sale or entry to the transportation system. The CDS shall perform these velocity checks as part of the acceptance of Smart Media prior to the start of the authorization process.

All parameter settings for functions described under this heading shall be table-driven. Tables governing velocity checks for credit cards shall function independently from those for other card types.

To support use of credit cards, the CDS shall, at a minimum, provide the following:

- Check the credit card number and transaction value against WMATA-definable and modifiable tables (velocity check parameters) that define:
    - The minimum amount (e.g. $3.00);
    - Maximum chargeable amount regardless of fare;
    - Maximum chargeable amount regardless of fare in a defined period;
    - Maximum chargeable amount for any particular fare in a defined period;
    - Maximum fare charged in a defined period for any particular fare in a defined period; and
    - Maximum chargeable amount in a defined period.
- Maintain authorized credit card sales information on a rolling, 6-month basis, with the oldest data archived in a manner consistent with the requirements of Section 16.

- Route transactions to appropriate financial institutions or clearinghouses for authorization.

- Complete authorization requests within the maximum time as identified in Section 3.

- Transmit the results of the authorization request to the initiating NEPP device for completion of the transaction, and record all required information within the CDS for reporting, reconciliation, and auditing purposes.

- At the end of each business day, as mutually agreed by WMATA and the merchant acquirer, automatically provide banks/clearing houses with necessary settlement data.

- If the authorization request is approved, and the Smart Media and a receipt are issued, confirm the sale and record for settlement, audit, and tracking purposes.

- If the fare/Smart Media is not issued, or the Customer has not passed through the faregate/turnstile aisle within the designated time period, be capable based on settable parameters of generating a reversal for the bank/clearing house, and record the reversal and the bank/clearinghouse response for reporting, reconciliation, and auditing purposes. Purchase and usage transactions shall have separate parameters to generate reversals.

- If the authorization is denied, display the required denial message at the NEPP Device and record for audit and tracking purposes, and use by Customer Support applications.

- If the fare/Smart Media is issued, and communication drops, for any reason prior to confirmation of the sale at the CDS, the System shall be capable of appropriately processing the delayed confirmation once it is received at the CDS.

- Utilize a standard interface and protocol, as approved by WMATA, for communications and data transfer.

4.1.3.3 Debit Card Processing

The CDS shall serve as the central processor for customer Smart Media purchases that have debit or ATM cards as the payment medium. Valid card and transaction data shall be passed from an NEPP device through the CDS to a clearinghouse for transaction approval. Software resident on the CDS to accommodate this payment option shall conform to applicable ISO/IEC-8583 interface standards, Payment Card Industry (PCI) and federal requirements for this kind of transaction.

Velocity checks shall be performed in addition to the other checks and verifications performed, for each item of Smart Media processed. These checks shall be performed within the transaction times identified in Section 3.

All parameter settings for functions described under this heading shall be table-driven. Tables governing velocity checks for debit cards shall function independently from those for other card types.

To support the use of debit cards at all NEPP Devices, the CDS shall:

- Receive hardware encrypted debit card transmissions from the devices, and transmit hardware-encrypted messages to financial institution for transaction authorization;
- Check the debit card number for that sale against internal tables (velocity check parameters as identified in Section 4.1.3.2);
- Maintain rolling 6 months worth of debit card sales information, with the oldest data archived in a manner consistent with the requirements of Section 16;
- Complete entire authorization process within the maximum time as identified in Section 3;
- Transmit the results of the authorization request to the initiating device for completion of the transaction, and record all required information within the CDS for audit and tracking purposes;
- If the authorization request is approved,
    - And the fare/Smart Media and a receipt is issued, confirm the sale and record for settlement, audit and tracking purposes;

- And the fare/Smart Media is not issued, generate a reversal for the bank/clearing house, and record the reversal and the bank/clearing house response for audit and tracking purposes.

- If the authorization is denied, display the denial code and customer message at the device, and record for audit and tracking purposes;

- If the fare/Smart Media is issued, and communication drops, for any reason prior to confirmation of the sale at the CDS, the System shall be capable of appropriately processing the delayed confirmation once it is received at the CDS;

- If the fare/Smart Media is not issued, or the Customer has not passed through the faregate/turnstile aisle within the designated time period, generate a reversal for the bank/clearing house, and record the reversal and the bank/clearinghouse response for reporting, reconciliation, and auditing purposes;

- Utilize a standard interface and protocol, as approved by WMATA, for communications and data transfer.

The Contractor shall not introduce technical or design features that prevent forward compatibility with standards of the financial services and payment industries. WMATA requires that all aspects of the NEPP System comply with generally accepted operating procedures and practices for processing electronic funds transfers of the financial services and payments industries.

4.1.3.4 PIN Debit Encryption Processing

The NEPP shall provide a means for securely processing and transmitting PINs used in PIN debit transactions. This shall include use of Hardware Security Modules (HSMs) within the WMATA NEPP environment for decryption (using WMATA keys) and reencryption (using bank PIN encryption keys) of PINs prior to submission to bank card clearinghouse(s).

To the extent possible, the Contractor shall integrate WMATA's existing Atalla-compatible Hardware Security Modules for use by the NEPP. WMATA will at its sole discretion decide to permit the Contractor to use alternative HSMs, upon written request.

The Bank Card Processing Server (BCPS) shall have the capability to store and process keys and cryptograms as required, and request and/or accept new bank PIN encryption keys based on WMATA-settable parameters (time and number of transactions). Currently, new bank PIN encryption keys are not requested by WMATA but are transmitted approximately every hour. The BCPS shall appropriately handle all transactions "in-flight" during key exchanges so as to not interrupt transaction processing.

Contractor shall provide WMATA all support and procedures necessary to enable the use of WMATA's existing HSMs appropriately for NEPP processing. HSMs used for current Debit transactional processing will not be re-configured to support NEPP; the BCPS will need to utilize the HSMs as configured for WMATA's current debit processing. WMATA shall provide the information necessary for the BCPS to pass messages to the HSMs. Changes to the current configuration will not be permitted as such may affect current debit processing.

With Contractor support, WMATA will create new encryption key components and applicable cryptograms that can be utilized by the BCPS. WMATA will maintain responsibility for updating HSMs if required.

WMATA will be responsible for injection of all PIN pads using WMATA QA and production keys, including spares. The Contractor shall provide WMATA with all tools and procedures necessary to enable WMATA to perform key injections.

For initial injections, Contractor shall propose a schedule, for WMATA review and approval, of a requested the PIN Pad injection schedule at least sixty (60) days prior to any key injection by WMATA. **CDRL 4-2**

The Contractor shall follow generally accepted best practices for shipping PIN pads to a WMATA-designated location for injection. WMATA envisions being capable of accepting all PIN pads in a single delivery but may prefer PIN pads to be shipped in phases in accordance with the equipment installation schedule to minimize on-site storage by WMATA.

To allow for injection of production keys, Contractor shall provide the PIN Pads to WMATA to ensure delivery not less than twenty-one days days prior to their scheduled installation. PIN pads requiring QA key injection shall be provided in advance to allow for reasonable time to perform key injection by WMATA.

WMATA will store injected spare PIN pads in accordance with internal policies and procedures; WMATA will provide delivery of injected PIN pads to NEPP device locations for installation by the Contractor during initial installation and warranty period. WMATA will provide on-site oversight during all installations until the PIN Pads are securely installed in the devices.

WMATA will provide on-site support during PIN Pad removals and will be responsible for the PIN Pads once removed from the devices to ensure proper key destruction and for delivery to the WMATA-designated location.

Contractor shall be responsible for the shipping, receipt, and tracking of PIN pads requiring repair during warranty period. WMATA will perform re-injections of PIN pads upon receipt back from repair. Spares injected with production keys shall remain in the control of WMATA at all times until installation in a device by the Contractor.

Contractor shall provide all coordination and project management for design, planning and implementing the PIN debit encryption process, subject to WMATA approval, and in accordance with all WMATA policies and procedures, and financial industry requirements (e.g. PCI PIN Security, TG-3, etc.). WMATA currently meets applicable PCI PIN Security and TG-3 requirements for PIN debit processing, and Contractor shall work with WMATA to ensure uninterrupted compliance with these and other applicable security requirements including required recurring audits.

The Contractor shall not be allowed to utilize WMATA production keys in any environment not on WMATA property without the written approval of WMATA. WMATA HSMs will also be available for use by the NEPP at WMATA's disaster recovery facility.

In all cases, WMATA will be responsible for all injection of all PIN pads using WMATA QA and production keys.

4.1.4 Account Replenishment

The NEPP System CDS shall provide automatic and *ad hoc* (customer-initiated) replenishment functionality for Smart Media accounts. The number of accounts that permit replenishment shall have no limit.

A functional description of all account replenishment methods shall be provided at the Preliminary Design Review for review by WMATA and for approval by WMATA at the Final Design Review. This information shall include the design or the operational flows, screens, functions and other similar information and shall include increasing detail with each design review step. **CDRL 4-3**

The following methods of replenishment shall be provided.

4.1.4.1 Subscription Replenishment

With Subscription Replenishment, a customer's registered account is automatically loaded with a pre-determined, approved value or pass when the available stored value balance falls below a defined amount or when a pass expires. Repleshment parameters such as the replishment thresholds and amounts, and for passes the number of days prior to pass expiration to charge a customer's account, shall be settable for all fare products (i.e. each type of stored value, each type of pass). For passes, it shall be possible to disable the replenishment occurrence prior to expiration. In such cases, pass replenishment shall function as described below.

The NEPP shall support at least the following four types of Subscription Replenishment programs:

- Recurring Value Program - customers receive a set stored value replenishment each period based on receipt of payment at WMATA. Once the payment has been received by WMATA, an action list item is performed to add value to the account. A request for funds shall be initiated prior to adding value to the customer account.

- Threshold Value Program - customers receive a set stored value replenishment each time the account value falls below a given amount, based on receipt of payment at WMATA. Once the payment has been received by WMATA, an action list item is performed to add value to the account. A request for funds shall be initiated prior to adding value to the customer account.

- Threshold Floating Pass Program – customers receive a set floating period pass each time they use their associated Smart Media when their account has no valid pass, based on receipt of payment at WMATA. Once WMATA receives payment, an action list item is performed to add the pass to the account. A request for funds shall be initiated prior to adding the pass to the customer account. This request for funds occurs a WMATA-defined number of business days prior to expiration date of the pass.

- Recurring Pass Program - customers receive a pass on a recurring basis. This can be initiated without payment of funds for the pass. If payment is not received in time, the privilege can be revoked, and as the payer is known, WMATA can attempt to retrieve appropriate funds.

Customer accounts shall have the capability to have both a pass and stored value. If the Customer uses Smart Media with a calendar pass for transportation services of a higher zone than is covered by the Customer's pass, then an appropriate amount (either upgrade or full fare) shall be deducted from the cutomer's funding mechanism for the account, if the customer has selected to activate this function in the Smart Media account.

With a credit card, an authorization is requested, and if confirmed, the value and/or pass validity is added to the account. For other forms of payment, the system will only initiate a load to the Customer account when the system is directed to do so with a "confirmation" of payment.

4.1.4.2 Ad Hoc Replenishment

Using the Internet, an FVD, the NEPP Customer Service Center, or other authorized replenishment methods, the NEPP shall enable Customers to replenish their accounts on demand.

4.2 Fare Calculations

Basic elements provided by the NEPP System for the purposes of fare calculation and identification of validity for the Smart Media shall include the following as a minimum:

- All Smart Media "taps" at PPTs shall be recorded as segments of trips by the CDS;

- The CDS shall assemble trip segments into actual Customer trips based on WMATA-defined parameters;

- All data read from “taps” and all payments made shall be transferred in real-time to the CDS. This data shall be stored in the CDS to support all business functions of the NEPP System, including verification of Smart Media validity;

- Smart Media transactions shall append additional information to the data stream as needed, provided that neither the event of appending data nor the characteristics of the data conflict or interfere with compliance with open standards payment processing, or result in a degradation in NEPP performance requirements;

- All trips processed by the CDS shall be identified with an account number;

- CDS shall provide a settable parameters to allow WMATA to determine the appropriate fares to charge for entry taps that have no corresponding exit and exit taps that have no corresponding entry;

- Fare calculations shall be identify operating agency and provide data for appropriate fare calculations and funding across agencies;

- CDS settable parameters shall include ability to define a “trip” , how long to wait for segments to complete a trip calculation and timeframe to recalculate fare after initial processing in the event of delayed or missing transactions.

Prior to allowing the customer to enter the WMATA transportation system, each “tap” shall be authorized in real-time by comparison to information stored in the CDS account or based on the validity of the Smart Media as provided by the banking network.

- For non-bank-issued Smart Media, all information about the status of the Smart Media account shall reside at the CDS; and

- For bank-issued and other Open Payment Smart Media, the CDS shall authorize payments via interaction with the banking network.

The NEPP System authorization process shall query the CDS for the following:

- Status of a Pre-Paid account on WMATA and Partner-issued Smart Media;
- Validity of a Pre-Paid account on WMATA and Partner-issued Smart Media;
- Status of a Pay-As-You-Go account on WMATA and Partner-issued Smart Media;
- Validity of a Pay-As-You-Go account on WMATA and Partner-issued Smart Media;
- Status of bankcard or a Pre-Paid transit account;
- Validity of bankcard or a Pre-Paid transit account;
- Status of bankcard or a Pay-As-You-Go transit account; and
- Validity of bankcard or a Pay-As-You-Go transit account.

If an authorization request returns an approval, then the NEPP shall allow access to WMATA's transportation services.

If an authorization request returns a denial, then the NEPP shall prohibit access to WMATA's transportation services. A denial response shall end the transaction.

Contractor shall provide a fare pricing matrix to meet the requirements of each transit service as identified in Section 1 that shows how each transaction shall be priced for payment purposes at the Conceptual Design Review for WMATA Review, and at the Final Design Review for WMATA approval. **CDRL 4-4**

4.3 Payment Aggregation

The CDS shall have the capability to aggregate Pay-As-You-Go trips into a single payment authorization transaction. Individual Pay-As-You-Go trips shall be aggregated subject to table-driven parameters for the duration of the aggregation period (i.e., number of days and the number of calendar days) and the dollar amount of the payment transaction. These settings shall be configurable:

- By mode (individually and as setup as a group);

- By day of week (individually and as setup as a group);
- By route (individually and as setup as a group);
- By station/location (individually and as setup as a group); and
- For the entire NEPP.

The following parameters shall be provided for aggregation as a minimum:

- Time-based parameter settings shall be provided to permit WMATA to define the period of time at which aggregation of trips into a payment transaction shall occur;
- Amount-based parameter settings shall be provided to permit WMATA to define the dollar threshold when trips shall be aggregated and processed as a single payment transaction;
- The dollar value of the authorization amount in increments of $0.01;
- Brand, product and issuer types (i.e., card association brand, closed or open loop, etc.);
- Credit, Debit.

Aggregation parameters shall also be provided to allow for aggregation based on past usage and trends (e.g. settable criteria that would allow for different aggregation between an account with previous settable number of successful aggregated authorizations and an account without such previous settable number of successful authorizations).

WMATA shall be able to set parameters at the CDS, individually and in combination to suit their operational needs.

Prior to executing a payment transaction, the CDS shall capture “taps” and perform necessary authorizations to allow or deny entry based on the status of the account. The CDS shall also provide parameter settings that govern how authorizations for Pay-As-You-Go fares are processed. These parameter settings shall allow WMATA to set:

- The dollar value of the authorization amount at the time of the first tap within an aggregation period;
- Single or Double authorization capability.

The single authorization shall permit the CDS to authorize the Pay-As-You-Go only once during the aggregation period, at the first tap during the current period. The dollar value of the authorization shall be a table-driven parameter setting that is programmable at the CDS. The minimum authorization amount shall be $1.00; the maximum dollar amount shall correspond to the dollar threshold that shall stimulate an aggregated payment transaction and define the end of the current aggregation period. Such maximum amount shall be in compliane with all Federal regulations. The type of initial authorization message shall be settable (pre-authorization, authorization, zero-value account verification, etc.).

The CDS shall also have the capability to initiate a second authorization at the moment that aggregation for payment is being processed. The NEPP shall have the capability of reversing the initial authorization and processing the authorization at the conclusion of the aggregation period for the exact amount of the total purchase for Pay-As-You-Go.

In addition to the above, the CDCRS shall also allow for additional interim authorizations based on settable parameters after the initial authorization of an aggregation period but before any additional final aggregated authorization.

The CDS shall be able to automatically repost aggregated transactions that have been denied. This capability shall be available for implementation in the event that WMATA chooses to accept bank-issued and other Open Payment Smart Media. To support this capability, the CDS shall capture decline codes returned by merchant acquirers and determine whether the decline was a “hard” decline (i.e., a lost or stolen card or device) or a “soft” decline (i.e., a temporarily inactive account because of an overdraft or similar status). The CDS shall have table-driven parameters for time and count that shall permit reposting of soft-declines.

Contractor shall act on WMATA’s behalf to coordinate any required card association or payment network operating regulations and rules waivers that may be needed to process usage and payment transactions. WMATA shall have the right to approve any written or formal requests on their behalf prior to submission to a card association or payment network.

4.4 Risk Mitigation

Risk shall be mitigated to ensure that risk performance falls within acceptable risk management performance as identified by the financial industry.

The Contractor shall comply with all risk management procedures and guidelines of the financial services industry and payment card associations regarding acceptance of contactless credit and debit cards. Similarly, the NEPP System shall apply those procedures and techniques in managing risk for Smart Media issued by WMATA. The NEPP System shall provide for the following mitigations:

- PCI Compliance;
- Fraud Detection;
- On-Line Operation;
- Orphan Mode Operation (store and forward);
- Chargeback Management.

Contractor shall provide complete information on all risk mitigation features and functions provided for the payment processing, including security measures implemented, to WMATA at the Preliminary Design Review and at the Final Design Review for review and approval purposes. **CDRL 4-5**

4.4.1 Card Industry Security Requirements

The NEPP System shall accept credit and debit media as a form of payment. The entire NEPP System, all NEPP devices that process credit or debit cards, all communications and computer systems comprising the entire NEPP System and all interfaces with the existing WMATA system components, shall be in full compliance with the data security standards as identified in Section 2.

4.4.2 Fraud Detection

The NEPP System shall provide a dynamic review of ongoing and historical processing data to enable detection of suspicious purchase and usage activity. This dynamic review shall permit immediate remedial steps, primarily in the form of hot listing of contactless Smart Media and other Contactless Smart Media accepted for fare payment.

Contractor shall provide complete information on the fraud detection and identification features provided for the payment processing, including security measures implemented, to WMATA at the Preliminary Design Review and at the Final Design Review for review and approval. **CDRL 4-6**

4.4.3 On-Line Authorization

For all Smart Media, online access to the CDS is required for authorization. For contactless bankcards, access through the CDS to card association databases of active and inactive Smart Media shall be provided as discussed in Section 16.

The NEPP System shall support risk management procedures, systems, and activities that extend across a full range of parameters, including but not limited to:

- Pre-Paid purchase amount by account;
- Pre-Paid fare product purchase by type;
- Frequency of Pre-Paid intra-business day purchase, set by time interval;
- Frequency of Pre-Paid inter-business day purchase, set by time interval;
- Frequency of Pay-As-You-Go usage by location and time;
- Total Value of Pay-As-You-Go usage, intra-business day purchase, set by time interval; and
- Total Value of Pay-As-You-Go usage, inter-business day purchase, set by time interval.

The System shall provide for settable parameters to limit the number of usages by ride and total fare amount for a Smart Media in a given time period. This shall be independently settable for a terminal, station and systemwide.

4.4.4 Orphan Mode Operation

In the event that real-time authorizations are interrupted because of telecommunications failures, or failures to receive an authorization response from the CDS within a WMATA-specified time period (See Section 4), operation in the orphan mode shall be employed. During the time of operation in the orphan mode, the NEPP System shall perform “stand-in” transactions until proper network communications are restored and transactions can be processed in accordance with On-Line Authorization requirements. The orphan mode authentication is distinct from the online, real-time authorization process typical of payment transaction processing; it is not governed by the merchant in the case of financial industry-issued Smart Media.

After communications is properly restored, the NEPP System shall upload data from orphaned NEPP equipment, process the data, and then globally refresh all NEPP equipment, components, and systems and account for all payment and usage transactions.

Orphan mode operation shall provide for and deploy additional risk mitigation procedures. These shall include such processes as authentication of the Smart Media or Smart Media at the point of presentment to the reader. The System shall provide for settable optional parameters to limit the number of usages for a Smart Media and for the maximum number of transactions that a device can process in orphan mode before automatically going out of service. Contractor shall provide complete information on the orphan mode, including additional security measures implemented to WMATA at the Preliminary Design Review and at the Final Design Review for review and approval. **CDRL 4-7**

4.4.5 Chargeback Management

In support of acceptance of payments made with bank-issued Smart Media, the NEPP System shall support management of chargebacks, and related inquiries and disputes according to business rules and procedural requirements defined by card associations and merchant acquirers. Key business processes to be accommodated by the NEPP System shall include, but shall not be limited to:

- Accessing, compiling, and responding with required transaction information;
- Recording and tracking of all documents, dates received and processed by staff;

- Assessing, processing and administering refunds;
- Processing and administration of payment adjustments for customer claims;
- Automated daily and monthly reconciliation by card types and by fraud and non-fraud chargeback categories;
- Generating end-user initiated ad hoc status reports across all processing, reconciliation and reporting functions.

Contractor shall furnish documentation at the Conceptual Design Review, Preliminary and Final Design Reviews to provide full details for the chargeback processing methodologies and procedures **CDRL 4-8**

4.5 Claims Processing

The NEPP System shall efficiently provide supporting information to enable WMATA to address inquiries and complaints from customers. Processing of claims supported by the back-office (other than charge backs) shall be addressed in two categories:

- Claims resulting from the sale or reload of Smart Media or open standard contactless devices at points of sale owned or operated by WMATA;
- Claims of an inaccurate fare payment calculation resulting from the acceptance of Smart Media or open standard contactless devices. These claims may be for payments of Pre-Paid purchases, or as for Pay-As-You-Go transactions at fare gates, bus fare boxes, and other points of entry to WMATA's transit system.

The NEPP System shall gather and synthesize claims from all sources of Customer contact with the WMATA, including but not limited to:

- The Web Site provided by the Contractor;
- Customers' phone communications with the Customer Call Center;
- Letters, text messages, and e-mails directed to WMATA.

Data captured for claims processing shall be consistent with data required for processing payment claims in an open standards, account-based system. At a minimum, the NEPP System shall capture and process the following information:

- Customer name, address, phone number, and email account;
- Account number and payment media type and issuer;
- Claim reference number;
- Date, time and location of incident;
- Amount of claim;
- Description of claim, with comments field;
- NEPP equipment serial number;
- Comments field for investigation process;
- Investigation result code;
- Approval code and authorizing entity or individual;
- Claim resolution amount;
- Method of claim resolution;
- Resolution date;
- Processing date.

Claim disposition shall be fully automated so that investigation and resolution can occur typically within the same business day. The NEPP System shall support the following resolution processes:

- Calculation of pro rata payment amounts for all fare products based on time and date of claim receipt;
- Menu driven selection of resolution codes and descriptions;
- Ability to apply credits to customer accounts for next business day payment by agency;
- Reporting of claims resolved;

- Preparation of a consolidated financial statement and reconciliation to settlement files;
- Tracking of claims processed and outstanding claims in queue;
- Account closeout; and
- Transfers of balances and historical data to new accounts.

4.6 Data and Reporting Requirements

The NEPP system shall support the logging, storage, backup, and retrieval of information regarding such data transmissions, including timing of the transmission, data transmitted, and status of the transmission, for both individual transactions and entire files, such as settlement files.

4.6.1 Payment Parameters

The CDS shall provide table-driven parameters for all elements associated with the payment processes. The range and flexibility of parameter settings available at the CDS shall permit WMATA to set pricing by route, mode of transportation, time of day, pre-defined periods, and other criteria as warranted by WMATA's fare policy or by WMATA's procedures.

All parameter settings shall be controlled through the CDS and applicable to all accounts, whether active or inactive, in the NEPP system. Contractor shall furnish documentation at the Preliminary Design Review and Final Design Review to provide full details on these parameters, including the proposed settings as a part of the Final Design Review. **CDRL 4-9**

4.6.2 Data Integrity

The CDS shall support periodic data integrity checks for all data that is captured for reporting analysis. Accurate and complete file downloads are essential to the proper operation of the NEPP System, including the reporting and analytical support functions.

4.7 Communications

The communications interface between the BCPS and the clearing houses shall utilize a transparent TCP/IP protocol, with a dedicated IP address and TCP/IP port. The Contractor's interface shall provide for an approved commercially available hardware encryption solution.

The Contractor shall be responsible for developing, testing, and certifying the interface connection between the BCPS to each card clearinghouse. The Contractor shall also provide all associated software and hardware for purposes of encrypting and transmitting the required data for determination of card validity and fund availability for approving (or rejecting) bank card transactions initiated at all NEPP equipment.

The NEPP System shall be able to simultaneously process bankcard transactions from all NEPP devices and to the associated bankcard clearing institutions. The NEPP System shall be sized and configured such that the length of time to completely process a transaction does not under normal conditions exceed the maximum time as identified in Section 4, including the time for network traffic.

4.8 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 4-1	Provide full details for bankcard processing parameters, including suggested settings and rationale.	4.1.3.1	CDR, PDR, FDR	Yes
CDRL 4-2	Provide proposed process and schedule for initial PIN Pad injections,	4.1.3.4	PDR	Yes
CDRL 4-3	Provide a functional description of all replenishment methods including the design or the operational flows, screens, functions and other similar information.	4.1.4	PDR, FDR	Yes
CDRL 4-4	Provide fare pricing matrix to meet the requirements of each transit service as identified in Section 1 that shows how each transaction shall be priced for payment purposes	4.2	CDR, FDR	Yes
CDRL 4-5	Provide complete information on all risk mitigation features and functions provided for the payment processing, including security measures implemented.	4.4	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
CDRL 4-6	Provide complete information on the fraud detection and identification features provided for the payment processing, including security measures implemented.	4.4.2	PDR, FDR	Yes
CDRL 4-7	Provide complete information on the orphan mode, including additional security measures implemented.	4.4.4	PDR, FDR	Yes
CDRL 4-8	Provide full details for the chargeback processing methodologies and procedures.	4.4.5	PDR, FDR	Yes
CDRL 4-9	Provide full details on payment processing parameters, including the proposed settings as a part of the Final Design Review.	4.6.1	PDR, FDR	Yes

End of Section 4

Section 5 – Applications
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5 APPLICATIONS

The NEPP is envisioned to provide WMATA customers with a wide array of new options for fare payment that can grow and evolve in response to market and technology changes. However, it is also envisioned as a new system that provides customers with an increased level of service and expanded usability.

A major component in accomplishing this vision for the NEPP will be the deployment of multiple software-based applications. These applications are intended to provide WMATA with the ability to offer services that reflect the ever-evolving needs and expectations of its customers regarding fare payment, account management, and other service functions.

As appropriate, applications shall be able to provide dashboard style reporting. This shall include the ability to provide the current status and "pulse" of the system, including current ridership, areas of high and low traffic, and statistics regarding recent revenue collection.

5.1 Web-Based Applications

The NEPP shall include a series of web-based applications, designed to provide enhanced customer interaction and customer service.

From the customer perspective, all NEPP applications shall look and feel like extensions of existing WMATA websites. To support this, all web-based NEPP applications shall be easily accessible from the WMATA website. Additionally, all NEPP web applications shall utilize the same design theme(s) as the existing WMATA websites.

Web-based applications shall utilize standard design languages, and support all web browsers in common use with open architecture at the time of system deployment. Additionally, all web-based applications shall follow industry best practices for web page design, and utilize "radio buttons," check boxes, pull-down menus, fill-in-the-blank spaces, and other common features to simplify customer selection and input.

All web applications shall be certified secure to Verisign® or other similar standard. All transaction processing shall be compliant with applicable Payment Card Industry (PCI) standards.

Transaction data, administrative and work order-processing web pages shall be secured with no less than 128-bit Secure Sockets Layer (SSL) encryption.

As part of the NEPP, all web-based applications shall be hosted within the CDS (Section 16).

5.1.1 Customer Services Application (CSA)

The web-based Customer Services Application (CSA) shall serve as the E-Commerce Web Site for the NEPP. This site shall provide customers with sales and support services for all NEPP functionality, including account management.

The CSA shall allow customers to purchase smart media, create an account (for one or more smart media), register smart media, unregister smart media, and add period passes and stored value to accounts. Customers shall also be capable of seamlessly linking new smart media to an existing account (e.g. when their existing smart media is lost/stolen/expired), with all fare calculations and financial transactions processed accurately.

For contactless credit, debit and prepaid media, the CSA shall use best available means to:

- Verify that such media is contactless enabled so as to minimize the possibility that a customer will register a non-contactless enabled media;
- Allow for efficient handling of cards that may use a common Primary Account Number (PAN) but be assigned to different individuals;
- Allow for efficient handling of cards that may have a different PAN printed in the front of the card/device than the PAN stored on the chip.

Additionally, this application shall provide customers with detailed information regarding account history and smart media usage. Customers shall be able to create an account to see usage without having to prepay for fare purchases.

The CSA shall also allow customers to link accounts with ISO/IEC-14443 compliant smart media for use within the NEPP. Through this application, customers shall also be capable of establishing and managing links from their account to current, emerging, and market-driven payment sources, including (for example) checking/savings bank accounts, PayPal accounts, SMS payments, bill payments, etc.

It is intended that the CSA be the primary mechanism for customer account management. All other customer service systems, smart media, and equipment, will be configured to first guide customers to this website for answers and support with the NEPP system.

The CSA shall permit the Customer to track accounts and smart media usage for individual smart media as well as for all smart media for the account.

5.1.1.1 Customer Service Application (CSA) Design

5.1.1.1.1 Web Page User Interface and Functionality

The NEPP CSA web pages shall follow standard web page design practices and utilize “radio buttons,” check boxes, pull-down menus, fill-in-the-blank spaces, and other common features to simplify product selection and purchases. The web based applications shall include a “shopping cart” feature that allows users to add, delete, and modify selections, and when ready, conduct a single transaction to complete the purchase.

The Contractor shall provide distinct web page types to support NEPP E-Commerce operations, and customer support. Each distinct web page type shall be designed and optimized according to the purposes of the page. The specific web pages required as part of the CSA and the detailed functionality requirements of each is provided in Section 22.2.3 Internet-Based Service.

5.1.1.1.2 Compatibility with WMATA’s Web Site

The NEPP CSA shall be connected with WMATA’s existing web pages. Users will have the ability to switch between pages hosted by the Contractor and those hosted by the current WMATA web site host. Each web site will have a link to the other web site. Additionally, all customer facing NEPP websites shall support shall be integrated with existing WMATA websites to provide for “single account” functionality that allow a single login account to manage SmarTrip and NEPP fare media.

Log-in status for the customer on the CSA shall be preserved when switching between the CSA and the current WMATA web site. While switching between the CSA and current WMATA site, customers shall be automatically logged off from the CSA following the WMATA configured period of inactivity.

The PHP web programming language shall not be utilized in any portion of the CSA site. All design aspects of the Contractor-developed web pages shall be subject to WMATA review at PDR and approval at FDR. **CDRL 5-1**

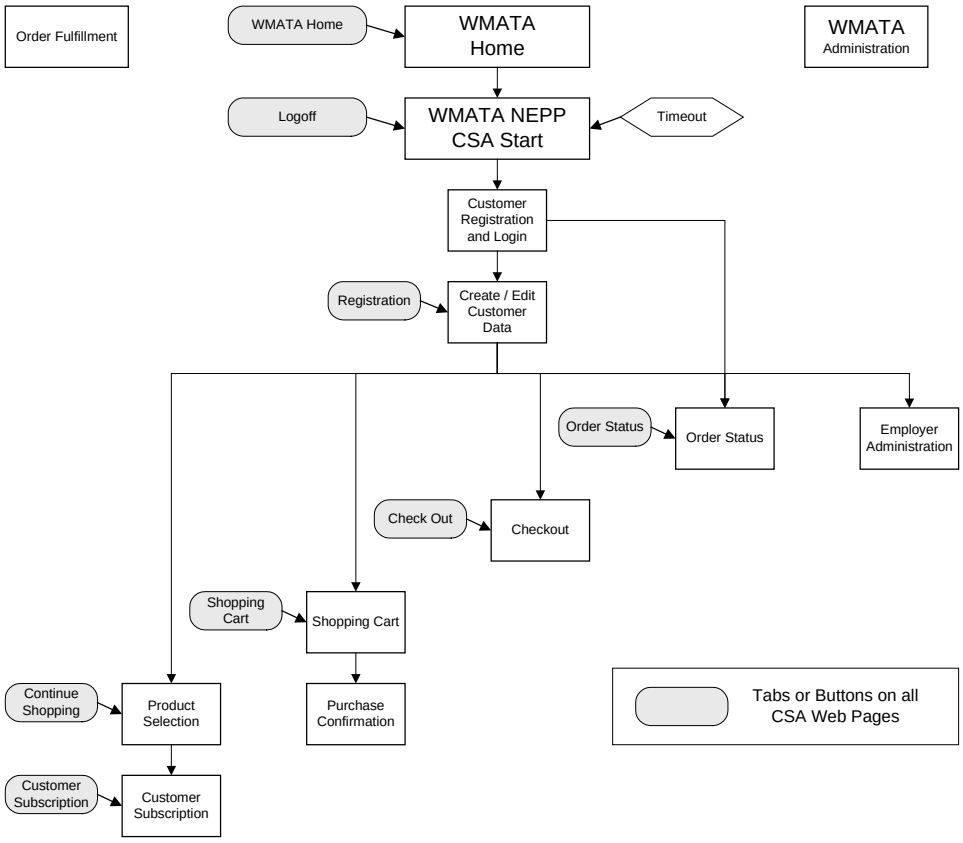
5.1.1.1.3 *Links to and from WMATA and Regional Partners Web Sites*

WMATA and Regional Partners current web designers shall add one or more links on its current web pages to direct users to the NEPP CSA web pages. The CSA web pages shall include one or more links back to relevant pages on the WMATA/Regional Partners web site. Every Contractor-designed web page shall include at minimum a link back to the WMATA/Regional Partners home page and a link to WMATA/Regional Partners Sales and Customer Support Start page. Both the Contractor and WMATA shall identify additional links to WMATA//Regional Partners web pages or other web pages at the Preliminary and Final Design Reviews. **CDRL 5-2**

5.1.1.1.4 *Site Map*

The site map below portrays an example of one possible layout for the Contractor-developed CSA web pages. It is supplied here for information purposes and to enhance the Contractor's understanding for this system element. The drawing as depicted shall not be construed to be a design that is definitive or, as a requirement of the Contract.

Figure 5-1: WMATA NEPP Customer Service Application (CSA) Web Site Map



5.1.1.1.5 Performance Criteria

The Contractor-designed CSA web pages shall utilize standard design languages, and shall support all web browsers in common use with open architecture at the time of contract award. The CSA web pages shall support use by personal computers as well as hand-held devices such as Personal Digital Assistants (PDAs) and web-enabled mobile phones.

5.1.1.1.6 Security

All web pages designed by the Contractor that include E-Commerce transaction data shall be certified secure to Verisign® or other similar standards. All transaction processing shall be compliant with the Payment Card Industry (PCI) Data Security Standard. Transaction data and all administrative and work order-processing web pages shall be secured with no less than 128-bit Secure Sockets Layer (SSL) encryption.

5.1.1.1.7 Transaction Types to be Supported

Single Transactions

Using the selection screens, the “shopping cart,” and the “check-out” (payment) screens, the Contractor-designed CSA web pages shall enable customers to purchase one or more products, in single, multiple, and combinations of single and multiple quantities.

Subscription Transactions for Individuals

Individual customers shall be able to establish subscriptions for repeat transactions. Using similar screens for the single transactions, the subscription transaction screens shall enable customers to create, modify, and delete subscriptions for one or more product types in various quantities. Options for subscriptions shall include payment methods, frequency of delivery, delivery method, etc.

Employer Subsidized Smart Media Sales

Employers participating in transit benefit programs for their employees shall be able to self-administer new smart media accounts and as needed the bulk purchase of fare media. CSA web pages shall provide an employer’s authorized users the ability to create, modify, and delete employee transit benefits.

5.1.1.1.8 Cookies

Users of the CSA who enable their browser to store “cookies,” shall be able to opt to have the web page store on their computer or browser device information that will facilitate subsequent revisits to the web site. The cookie shall include prior data entry and selections, but shall exclude information that could be used to complete the payment information fields, such as the customer’s credit account number, expiration date, Card Verification Value (CVV), bank account information, and so forth. Using the cookie, the web page shall enable customers to repeat previous one-time transaction selections, automatically fill in name, and address information, shipping preferences, etc.

5.1.1.1.9 Administration

The Contractor-designed web pages shall be fully configurable, and offer authorized personnel the ability to modify the selection, price, descriptions, and images of products available for sale. Contractor shall provide change management procedures to support modifications to the web site. All such changes to the web site shall be largely driven by changes to the product records in the database. As necessary, other data tables or easily configurable files shall be used to configure the product selection web pages. The order in which products for sale appear on the selection page shall also be easily configurable by authorized personnel.

Other transaction choices, such as payment methods (i.e. credit media types accepted), shipping methods, shipping costs, and so on shall be easily configurable by authorized personnel by modifying files or data tables.

Access to the configuration parameters and the product database shall be strictly controlled via password protection schemes and secure web pages.

As appropriate, special database queries and reports shall be provided to assist authorized personnel in monitoring, administering, and managing the web site. These reports and queries shall be available only to authorized personnel through the password-protected secure administrative web pages.

5.1.1.1.10 NEPP Customer Service Application (CSA) Database

The Contractor shall supply a relational database as an integral part of the CSA. The database shall include one or more tables to record customer information, transaction data, products for sale, pricing information, etc. All data stored in the database shall be compliant with the PCI Data Security Standard (PCI-DSS).

The database shall include reports and queries that utilize Structured Query Language (SQL) to enable WMATA to assess sales history, revenue trends, individual patron transaction records, etc.

The CSA database shall record all data necessary for authorized personnel to operate and manage on-line NEPP sales.

When a new customer “registers” with the CSA, the appropriate records shall be populated. Changes to a customer’s records shall require the customer to make the modifications.

Transaction records shall be created automatically for each completed transaction.

Full information on the transaction records and data records, including structure, layout, valid ranges (where applicable) and other similar information to provide WMATA with a full understanding of the database recored stored shall be provided. **CDRL 5-3**

At minimum, the following tables and records shall be included in the database.

Customer Records

Stored in one or more tables, data records for each customer shall include at minimum:

- Customer identification number (unique for each customer);
- Customer login ID (unique for each customer);
- Customer login password (This field shall be encrypted);
- Name (Title, Last, First, Middle, Suffix);
- Mailing Address (Street, City, State, ZIP);
- Billing Address (Street, City, State, ZIP);
- Phone;
- Customer email address;
- Unalterable indentifying information for Media associated with Customer Account (such as Smart Media Chip Serial number if deemed unalterable at time of NEPP implementation);
- Customer status (By manually setting this field to “deny,” it shall be possible for WMATA to deny a customer further purchases, but the customer’s record shall remain in the database for recordkeeping purposes.)

Transaction Records

The CSA shall support transactions that contain multiple distinct items in a single purchase, as well as multiples of each item purchased. While each transaction shall have a unique identifying number, to support multiple different items in a single transaction, it shall be possible for multiple records in the transaction database to share a common transaction ID. Each completed transaction record shall at minimum include:

- Sequential transaction ID (unique per transaction, but multiple products may be purchased in a single transaction, so multiple records may share the same sequential transaction ID);
- Transaction item number (for example, in a transaction of five distinct products, five separate transaction records shall be created with this field ranging from 1 to 5; in a transaction with only a single product, a single record shall be created and this field shall be 1);
- Subscription identification number (if applicable);
- Customer identification number;
- Order date;
- Product identification number;
- Purchased quantity;
- Unit price;
- Sales tax (if applicable, for the purchased quantity of the associated item);
- Total transaction item value (where multiple product types are purchased in a single transaction, this field shall reflect the total of the specific product only, not the total of all product types purchased);
- Payment information (Multiple payment information fields shall be provided, which shall be determined by the payment method. All relevant payment data shall be included, and all payment data shall be encrypted as required to comply with the PCI Data Security Standard);
- Serial number (as applicable);

- Printed by user (yes / no);
- Shipping method (as applicable);
- Shipping cost;
- Shipping tracking number (as applicable);
- Order status (order entered / payment received / work order in progress / shipped / cancelled / etc.);
- Order status date (the date that the current order status was established);
- Order clerk identification (the identification of the clerk who generated the work order to complete the order, or the identification of the authorized user who manually changed the order status).

Product Records

Each product for sale on the CSA shall have a unique identification number and the following data fields at minimum:

- Product identification number (unique for each product);
- Product description;
- Price;
- Additional shipping cost (Some non-fare items may require additional shipping costs. The system shall support such charges.);
- Sales tax rate (Some products may be exempt from sales tax and shall have an assigned value of zero for this field. Some jurisdictions have variable sales tax rates, depending on the product; this field shall support such variable sales tax rates.);
- Subscription availability (customers shall be able to repeatedly purchase some products by setting up a subscription; it shall be possible to exclude some products from subscription purchases.);

- Bulk purchase availability (Employers shall be able to purchase fare media in bulk form for their employees. Only those products so designated shall be available for employer bulk purchases.);

- Serial number (No / Pre-printed / Printed Upon Issuance);

- Maximum quantity per transaction (this value shall permit restrictions to quantity purchases, as well as to reflect limited stock availability.);

- Availability (It shall be possible to "discontinue" a product, but the database shall retain a record of the product for recordkeeping purposes. Discontinued products shall not appear on the web pages. It shall also be possible to temporarily assign a product as "out of stock" or "unavailable" status.)

Subscription Records

One or more tables in the database shall track subscriptions for repeated transactions. Each subscribed transaction shall have an independent record. The system shall support multiple independent subscriptions per customer. Note that subscriptions shall be usable by individuals as well as by groups or employers who wish to purchase fare media in bulk quantities at regular intervals.

At minimum, each subscribed transaction record shall contain:

- Subscription identification number (unique for every subscribed transaction);

- Subscription item number (as with one-time transactions, subscribed transactions shall support multiple distinct item types in a single subscribed transaction);

- Customer identification number;

- Subscription initiation date;

- Subscription expiration date (customers shall be able to define a limit to the subscription. The CSA's E-Commerce system shall also support unlimited subscriptions and a WMATA defined and configurable maximum term);

- Subscription transaction frequency (i.e., weekly, monthly, quarterly, yearly);
- Customer payment information (This information shall be recorded only for customers who opt for subscription purchases. The information shall vary according to the payment type selected, and storage of this information shall be in full compliance with the PCI Data Security Standard);
- Subscription product identification number;
- Subscription delivery method.

Employer / Employee Records

At least three specific data tables shall support periodic purchase transactions for employers who wish to provide individualized transit benefits for their employees.

Employer Table

The database shall include a single table that contains information about all employers participating in the employer subsidy programs. Each record in this table shall contain at minimum:

- Employer ID number (unique for each employer);
- Company name;
- Company address;
- Contact name;
- Contact phone number;
- Contact email address;
- Employer payment method (pre-paid / post-billed);
- Employer EFT payment information (this information shall be stored in encrypted form);
- Periodicity (i.e., how often the employer's order is to be filled – weekly, monthly, quarterly, annually);
- Employer account login;

- Employer account password (at minimum, this field shall be encrypted);
- Employer status (it shall be possible to deactivate an employer's participation in the program, but all records of the employer shall be retained in the database for recordkeeping purposes).

The Contractor shall provide one or more WMATA administrative web pages to enable authorized staff members to add, modify, and delete entries in the Employer Table.

Employer-Employee Tables

For each employer participating in the subsidy program, a table shall contain information about all of the employer's participating employees. Each record in the table shall contain at minimum:

- Employee ID number (This field shall be sequentially generated for the employer. By appending this number to the unique Employer ID number, each employee shall be uniquely identifiable.);
- Employee name;
- Provided product identification number;
- Periodicity (i.e., weekly, monthly, quarterly, annually);
- Smart media type;
- Assigned smart media serial number;
- Employee status (It shall be possible to discontinue an employee's participation in the program, but the database shall retain all records of the employee for recordkeeping purposes.)

The Employer-Employee table shall include no privacy-sensitive data such as social security numbers. It shall be the responsibility of the employer to manage the associations between the Employee ID assigned by the system to the company's internal employee identification methods.

To minimize the administrative burden on WMATA, the Contractor shall develop one or more Employer Administrative web pages as described in Section. To facilitate the initial population of this table, the Contractor shall also provide a means by which a simple spreadsheet, comma-delimited file, or other such means may be used to import data into the table.

Employer Transaction Records

Similar in nature to the transaction records for individual customers described in Section 5.1.1.1.10, the Employer Transaction Records table shall include information about every completed employer transaction. Data fields in this table shall enable WMATA and the employer to track the progress of orders and payments, as well as to review historical data regarding previously completed transactions.

Synchronization with NEPP System

The Contractor shall be responsible for ensuring that the CDS Database and the CSA Databases interact. The CSA Database shall be responsible for publishing information to the CDS any time a record is added, deleted, or modified. This includes when any transaction is completed or when a customer has updated any on-line information. In addition, the CSA Database shall be capable of receiving updated information from the CDS Database at any time, for any record. This includes media information, customer information, as well as fare tables.

The CSA Database shall not retain any information that is not published to the CDS.

5.1.1.1.11 Transaction Processing

All applicable financial transactions conducted by the CSA shall comply with ISO 8583. All credit media transactions shall utilize address verification and CCID verification.

5.1.1.1.12 Subscription Transaction

The CSA Database shall include subscription records as described in Section 5.1.1.1.10. These records shall be used to automatically generate purchase transactions according to the product, frequency, delivery method, and payment information contained in the records. While the CSA shall be a method for establishing and maintaining automated transactions, the CDS shall be responsible for processing all reoccurring transactions.

As part of the NEPP, the CSA shall also automatically send reminder e-mails to subscription patrons when their on-file credit media is about to expire, and when a subscription is about to expire. These reminder emails shall be sent to the customer's email address on file. The warning period and frequency of emails shall be configurable by authorized users.

5.1.1.2 Customer Service Application (CSA) Hosting

The Contractor shall provide secure hosting services for the CSA designed to support WMATA's on-line sales and all CSA functionality. In addition to accepting and processing purchase requests, the hosting service shall also provide WMATA with necessary reports and other tools to fulfill and track fare media sales from individual customers as well as from groups (such as employers, Retail Sales Locations and other venues) who purchase fare media in bulk quantities.

5.1.1.2.1 CSA to be Hosted

The Contractor shall provide web site hosting services for the NEPP CSA, as well as the NEPP Database and all associated Application Program Interfaces (APIs), including necessary interfaces for and integration with the existing WMATA web site.

All hosted servers utilized to support the CSA shall be dedicated to this site, and not shared between multiple sites. The use of a shared server (virtual or physical) to support this site is not allowed. In addition, the database server shall be hosted on a different physical server than the web server.

If any server utilized for the CSA is implemented as a Linux Server, an enterprise version of Linux, such as SUSE or RedHat Enterprise Linux shall be utilized. Any implementation of a Linux server shall have the SELinux security functions enabled. Furthermore, the server shall have the Tripwire intrusion detection software installed. Daily Tripwire reports shall be emailed to WMATA IT Department's network administrator.

5.1.1.2.2 Availability of Service

Contractor shall provide web site hosting services that are highly reliable and provide best-of-industry availability to WMATA's on-line customers. The hosted web site shall be available no less than 99.99% of the time. Down time shall be less than one hour per year.

5.1.1.2.3 *Server and Networking Equipment Location*

All equipment on which the CSA is hosted shall be installed in a secure location that complies with the PCI Data Security Standard.

5.1.1.2.4 *Secure Transactions / Encryption*

All purchase transactions shall be secured, and shall utilize no less than 128-bit Secure Socket Layer (SSL) encryption. Similarly, all web pages utilized by administrators and work order clerks shall be secure sites utilizing 128-bit SSL encryption.

5.1.1.2.5 *Credit Media and Payment Processing*

The Contractor shall provide all interfaces to the payment service providers and clearinghouses required to process the variety of payment methods identified in this Technical Specification. All applicable payment process shall comply with ISO 8583. All bankcard transactions shall include address verification and Card Verification Value (CVV) verification.

5.1.1.2.6 *Transaction Volume to be Supported*

The Contractor shall provide web-hosting services that can process all sales volume, including maximum peak sales volumes experienced by the site, without unduly slowing the transaction speed as perceived by the end user. A minimum of 50,000 credit and debit transactions per hour shall be able to be processed by the hosted web software. During the duration of the contract, the Contractor shall also expand the capacity of the website as necessary to support sales volume increases without limitation.

5.1.1.3 Customer Services Application Mobile Accessibility

The web-based Customer Services Application (CSA) shall be accessible on all common mobile devices, including smart phones, wireless tablets and other similar interactive devices. To support this, the CSA shall be capable of rendering properly within the mobile browsers included on these devices. This shall enable customers to navigate all of the above outlined applications in a mobile environment without the need for loading additional applications.

5.1.2 Administrative Customer Service Application (ACSA)

The web-based Administrative Customer Service Application (ACSA) is intended for use by WMATA employees only. The ACSA will be the primary application for providing customer service and sales at fixed locations and through other customer service operations (Section 8).

To support this, the web-based ACSA shall be capable of all functions outlined in the Customer Service Application (Section 5.1.1). Beyond this, the ACSA shall be capable of creating accounts and modifying parameters, as well as configuring autoload or auto-replenishment setups.

Through the ACSA, users shall be able to research smart media/account history, correct erroneous charges, submit and resubmit credit/debit authorizations, add or remove smart media from bad number and invalid smart media lists, and cancel/invalidate smart media.

In addition, the ACSA shall be the primary tool for WMATA employees issuing reduced fare eligible smart media, including Reduced-fare and MetroAccess Identification cards, with or without cardholder photos.

To support this functionality, the ACSA shall be capable of interfacing with various peripherals, including: contactless smart media readers, cash drawers, digital cameras, and photo identification printers. ACSA shall also be capable of reviewing reduced-fare Smart Media verification transactions (section 16).

5.1.3 Preferred Vendor Sales Application (PVSA)

The NEPP shall include a web-based application to permit sales entities to provide smart media services. These sales entities will sign-up with WMATA, or its designated representative, to become an authorized sales and reload location for smart media. These sales locations shall not require any NEPP equipment but shall perform all functions through the web site using manual revenue collection processes.

Based on WMATA-definable parameters settable for each sales entity, fees shall be automatically charged to the user for the sale of all fares and smart media. These fees shall be transmitted to WMATA as a part of each sale. Detailed invoices shall be prepared by the NEPP for each sales entity based on information transmitted to the CDS with each sale.

In addition to accepting and processing purchase requests, the hosting service shall also provide WMATA with necessary reports and other tools to fulfill and track accounts and smart media usage for individual customers as well as from groups (such as employers, retail sales locations, and other venues) which issue and/or process smart media in bulk quantities.

5.1.4 Status Monitoring and Control Application (SMCA)

The Status Monitoring and Control Application (SMCA) shall monitor the status of the NEPP, including all field devices, data networks, and all data transfers.

The SMCA shall provide a full and complete real-time graphical and data representation for each location in the NEPP, including: Metrorail mezzanines, bus facilities, and parking facilities. Status shall be provided in five levels of detail: station, line subsection, line, operation (Metrorail, LRV/Trolley, etc.), and overall operation.

Status indications shall provide SMCA users the ability to easily differentiate vehicles which may not be in service (e.g. on a weekend) from vehicles with possible communications issues that need to be addressed.

For a parking facility, this information shall include, but not be limited to: visualization of parking lane operations, all lane status, all gate status, all lane light status, all lane counts, all gate cycles, all payments and other similar information.

When a location has more than one alarm in effect, the location shall be shown in the color of the highest priority alarm

In addition, the SMCA shall provide for full, remote control, of all equipment at any location. This shall include (but not be limited to), remote control of FVDs, and operation of barriers and gates.

The SMCA shall incorporate menu options to facilitate monitoring of unit status, system and unit security, network status, polling status, and links to external interfaces.

The SMCA monitor shall incorporate menus and screens supporting both the manual and automatic polling of transaction, status (receipts, change supply, smart media stock), and event log information. The system shall be able to designate the polling for all units of a particular type of fare device, a designated set of fare devices or individual units.

In addition, the SMCA shall be able to monitor connections to external telecommunications networks, and shall incorporate menus and screens to support this function

5.1.5 Parking Application

The NEPP shall provide for the generation of reports and queries. These reports and queries shall utilize any and all data from the parking system elements as identified in Section 14.

A web-based interface shall be provided that permits, through the use of a standard web browser, reports and queries to be defined, developed, stored and generated and the results of these queries and reports to be stored. User shall have opportunity to select the appropriate data storage location for the query/report, including locally at the Parking Operations Center.

5.2 Mobile Applications

With the NEPP envisioned as providing customers with enhanced convenience and greater options for self-service, it shall include support for the mobile environment. It is envisioned that the NEPP will incorporate multiple applications for the mobile environment.

All mobile applications shall be equipped to operate on the latest version of the mobile operations systems by Apple (iOS), Google (Android), Microsoft (Windows Phone), and RIM (BlackBerry OS) plus another four (4) platforms as selected by WMATA prior to final acceptance.

These applications shall be made available in self-contained packages that once selected, require no additional processes, input, or other operation for installation.

5.2.1 Mobile Customer Applications

The NEPP shall incorporate a suite of mobile applications that are intended to provide customers with greater convenience and offer increase self-service functions.

All Mobile Customer Applications shall be available through multiple sources. The applications shall be available to download from the WMATA website as well as from the CSA (Section 5.1.1).

In addition, the Mobile Customer Applications shall be made available through the primary software application outlets that are available at the time of system deployment. It is envisioned that, as a minimum, this would include the iPhone App Store, Android Market, Microsoft Marketplace, and BlackBerry App World.

Regardless of location, all Mobile Customer Applications shall be available for download without charge to a customer (excluding any charges that may incur from a wireless provider for data transmission).

5.2.1.1 Mobile System Information Application (MSIA)

The Mobile System Information Application (MSIA) is intended to be the primary source for customers to receive information and updates regarding WMATA service. The MSIA shall include service disruptions and delays, as well as equipment out of service.

In addition, the MSIA shall provide information for arrival of the next bus/train based on device GPS information as well as selection of location by the user.

5.2.1.2 Mobile Customer Service Application (MCSA)

The web-based Customer Service Application (Section 5.1.1) is intended to be the primary mechanism by which customers interact with the NEPP for payment, account management, and replenishment. The Mobile Customer Services Application (MCSA) is intended to be an extension of that system, providing customers with the capability to manage their account in a mobile environment.

To support the intended functionality, the MCSA shall support all functions and capabilities of the web-based CSA.

In addition, the MCSA shall be capable of provisioning all types of WMATA Smart Media "over-the-air" to a mobile devices such as those with NFC-capabilities. The WMATA Smart Media stored on a mobile device shall emulate the functionality for customers using other form factors such as cards.

Additionally, for environments such as proof-of-payment and Commuter Rail, mobile applications shall accommodate fare ticketing/payment in a manner that can accommodate visual inspection by agency personnel so as not to hinder operational efficiency when verifying a customer has paid their fare.

5.2.1.3 Mobile Parking Payment Application (MPPA)

As outlined in Section 1, WMATA operates several pay-by-space parking facilities. To support these operations, the Mobile Parking Payment Application (MPAA) will enable customers to pay for parking in these spaces, using a mobile device.

Upon payment, the MPAA shall communicate through the CDS to the parking system to register valid payment at the appropriate meter head for enforcement purposes and otherwise populate the necessary data elements in the parking system.

5.2.2 Mobile Administration and Sales Applications

In addition to the mobile customer applications, the NEPP shall incorporate additional mobile applications that are intended to provide WMATA employees and other authorized users enhanced system monitoring and control.

Unlike the Mobile Customer Applications, the Mobile Administration and Sales Applications shall not be available from any publically accessible outlets.

During the installation process, each Mobile Administration and Sales Application must require sufficient authorization, including the entering of security credentials, to inhibit the deployment of the software.

Through the CDS, each Mobile Administration and Sales application shall be restricted to running only one specified device. This will be enabled through the use of unique hardware identification including the MAC ID. Even if installed correctly, removal of a device from the approved list for a specific application shall disable it.

Through settings on the CDS and the installation procedure, a Mobile Administration and Sale Application shall be configured to operate for only one operating agency. It shall not be capable of running an application simultaneously for multiple transit agencies.

All sales devices shall be subject to the funds pool requirements identified in Section 2.

In the event that a device is removed from the approved list for a Mobile Administration and Sales Application, the device shall require administrative interaction before the application can function again.

5.2.2.1 Mobile Inspection Application (MIA)

The Mobile Inspection Application (MIA) is to be used for on-board inspection and validation of smart media in a mobile environment.

This application shall be capable of processing a piece of contactless smart media and interacting with its linked account on the CDS. Through this interaction, the MIA shall supply the CDS with sufficient information to determine the proper fare calculation, including inspection of period passes and deduction from existing balance.

When a customer's fare media is presented to the MIA, it shall read the fare media and shall be able to:

- Send the appropriate information as well as date/time and location to the CDS where the appropriate fare shall be calculated and deducted from the customer's account for all WMATA mobile operations;
- Validate fare payment by the bearer of the smart media or LUM in the LRV/Trolley environment;
- Identify a valid "Open Trip" which the operator will "Close" with the HSD after querying the customer for the destination location and entering the appropriate destination zone into the HSD; and
- Confirm a valid fare deducted from the customer's account.

When the MIA receives a message from the CDS regarding the payment, it shall display an indicator as follows:

- Green: Transaction is valid.
- Yellow: Transaction is valid, but attention is required, such as when the account balance is low or the pass is nearing expiration.
- Red: Transaction is rejected.

If a transaction is rejected, a message detailing why the rejection occurred shall also be provided.

The MIA shall not be able to perform any type of sales transaction.

Reporting

In addition to receipts, the MIA shall generate reports upon request by the operator The MIA shall be able to produce the following types of reports to support the operation of the NEPP:

- Verification summary report – A summary of all smart media verifications during the user's shift.

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 5-4**

5.2.2.2 Mobile Sales Application (MSA)

The Mobile Sales Application (MSA) is intended to be utilized for on-board sales of fares in a mobile environment. This could include sales by conductors on commuter rail operations.

In addition to the functions of the MIA, the MSA shall be capable of processing payments for transit services. This shall include accepting cash, credit/debit media, and all forms of emerging and market driven payment mechanisms for the purchase of any product outlined in the current fare table. All purchases shall be reflected in the CDS as an addition to the account with a second transaction reflected if the product is immediately used, such as during the purchase of a one way fare product.

The MSA shall also include the ability to read new contactless smart media, verify that it is not linked to an account in the CDS, and then establish an anonymous linked account for that smart media.

All credit/debit transactions that occur through the MSA shall occur in a PCI compliant manner.

Cash Processing

The MSA shall be capable of being configured to process the following customer transactions:

- Addition of Stored Value to existing Linked and Unlinked WMATA smart media accounts, in predetermined amounts, by cash payment;

- Addition of Stored Value to existing Linked and Unlinked WMATA smart media accounts, not limited to predetermined amounts, by cash payment;

- Addition of Stored Value to account associated with new, un-initialized, smart media, in predetermined amounts, by cash payment;

- Addition of Stored Value to account associated with new, un-initialized, smart media, not limited to predetermined amounts, by cash payment; and

- The sale of initialized and pre-valued Limited Use Media (LUM), by cash payment.

The structure and layout of all cash transaction records shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 5-5**

Credit Processing

The MSA shall be capable of being configured to be able to process the following customer transactions:

- Addition of Stored Value to existing Linked and Unlinked WMATA smart media accounts, in predetermined amounts, by credit payment;

- Addition of Stored Value to existing Linked and Unlinked WMATA smart media accounts, not limited to predetermined amounts, by credit payment;

- Addition of Stored Value to account associated with new, un-initialized, smart media, in predetermined amounts, by credit payment;

- Addition of Stored Value to account associated with new, un-initialized, smart media, not limited to predetermined amounts, by credit payment; and

- The sale of initialized and pre-valued Limited Use Media (LUM), by credit payment.

The structure and layout of all credit transaction records shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 5-6**

Reporting

In addition to receipts, the MSA shall generate reports upon request by the operator. The MSA shall be able to produce the following types of reports to support the operation of the NEPP:

- Transaction summary report – A summary of all smart media verifications, fare media sold, and revenues collected during the user's shift.
- Remittance report – A report that provides details of the revenues remitted by the user. These reports shall be uniquely serialized.
- Citation summary – A summary of all citations issued by the HSD user.
- Shift report – A report that provides details of sales and counts of smart media verifications performed during the shift.

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 5-7**

5.2.2.3 Mobile Status Monitoring Application (MSMA)

The Mobile Status Monitoring Application (MSMA) shall provide authorized users a mobile status of the NEPP. To support this, the MSMA shall provide all applications provided by the web-based Status Monitoring Program (Section 5.1.4)

5.2.2.4 Parking Payment via Mobile Devices

Mobile devices shall be able to be used for parking meter payments. This payment methodology shall require the Customer to pre-register and include a WMATA-approved payment method as part of their registration. Registration for this service shall be provided via the Internet as well as via the Customer Support System. Some of the benefits provided by the pay by mobile function include:

- Allow customers to use mobile devices to pay for parking;

- View and confirm transaction history; and
- Obtain and parking receipts online.

All design requirements for the Customer Support System (see Section 22) shall apply. The Central Data System (CDS) shall provide all necessary software and hardware required for the incorporation of this payment methodology into the NEPP System.

A complete description of this functionality shall be provided for WMATA review and approval at each design stage and shall include menu selections, screen layouts and other similar information to provide WMATA a complete understanding of the functionality. Design documents shall fully describe the functionality as defined for this function. **CDRL 5-8**

The following functionality shall be provided

5.2.2.4.1 *Customer Registration*

When the Customer registers, the following information shall be recorded as a minimum:

- Name
- Mailing Address
- Mobile Phone Number
- Vehicle License Plate Number(s)
- Credit Card, Debit Card or other funding mechanism available within the NEPP (Section 4)
- Email Account

Customers shall be able to add pay by mobile parking to an existing NEPP account or create a new account for pay by mobile parking.

After the Customer has registered, the function shall be available for immediate use. All parking transactions shall be available for review and printing by the Customer, using the Customer Support System. Transactions shall be retained by the CDS for Customer inspection for a minimum of one (1) year and available in a year-end transaction summary.

5.2.2.4.2 Customer Usage

Customer usage of Parking Payment by Mobile Device shall include the following steps:

- A Customer arrives at a parking meter and parks their vehicle in a space.
- The Customer enters their parking facility number, the meter identification number and the parking duration into their mobile phone and this information is forwarded to the CDS using standard text messaging, or via data entry into a web interface, based on the mobile device technology use by the passenger. Customers shall also have the self-service ability to provide a new alternate vehicle license plate number for single day use.
- When received at the CDS, the information is verified and the transaction is authorized using the mobile phone number or other defined unique identifier for account lookup.
- The vehicle is allocated to the identified parking meter at the parking facility identified and this information is stored, together with the appropriate expiration date and time.

5.2.2.4.3 Enforcement

The following steps shall occur when enforcement is being performed at the parking facility.

- The valid parking list is generated, based on the local transactions and the information from the CDS for the mobile phone payment.
- A single list is generated and provided to the enforcement agent to verify proper payment for space occupancy.
- The license plate provided as part of the Customer registration process is used to verify space occupancy for those pay by mobile Customers.

5.2.2.5 Third-Party Mobile Parking Payments

The Mobile Parking Payments functionality described above is a part of the NEPP. In addition the NEPP shall also be able to interface with third party-provided software for parking meter payments using similar processes to those in Section 5.2.2.4.

Interface between the third party-provided software and the NEPP shall include but not be limited to parking usage transaction updates to NEPP accounts and reconciliation of funds based on the contractual arrangements between WMATA and the third party.

APIs shall be developed and furnished to WMATA to accomplish all required interfaces. These APIs shall be provided and verified as identified in Section 17.

5.3 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 5-1	Provide information on all design aspects of the Contractor-developed web pages.	5.1.1.1.2	PDR, FDR	Yes
CDRL 5-2	Provide information on Contractor and WMATA identified additional links to WMATA web pages or other web pages.	5.1.1.1.3	PDR, FDR	Yes
CDRL 5-3	Provide full information on all databases utilized for the CSA applications	5.1.1.1.10	CDR, PDR, FDR	Yes
CDRL 5-4	Provide samples of Mobile Inspection reports.	5.2.2.1	PDR, FDR	Yes
CDRL 5-5	Provide information on structure and layout of all cash transaction records of Mobile Sales.	5.2.2.2	PDR, FDR	Yes
CDRL 5-6	Provide information on structure and layout of all credit transaction records of Mobile Sales.	5.2.2.2	PDR, FDR	Yes
CDRL 5-7	Provide samples of Mobile Sales reports.	5.2.2.2	PDR, FDR	Yes
CDRL 5-8	Provide a complete description of Parking via Mobile Devices functionality, including menu selections, screen layouts and other similar information to provide WMATA a complete understanding of the functionality.	5.2.2.4	CDR, PDR, FDR	Yes

End of Section 5

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6 FARE VENDING DEVICES

6.1 General

As part of the New Electronic Payments Program (NEPP), Fare Vending Devices (FVDs) shall be deployed at locations and stations identified by WMATA and its Regional Partners throughout their service areas. Each FVD shall be designed to operate as both a stand-alone unit, and on-line connected to the Central Data System (CDS) via the Communications network outlined in Section 15. The FVD shall not issue change to customers.

The FVD, including all controls and instructions shall be designed to facilitate a quick understanding by the Customer for its intended use, along with a rapid response to instructions. WMATA shall be able to customize the FVDs based on the functionality and types of modules installed as well as parameter settings. The FVDs and the functionality to be initially installed shall be as identified in Table 6-1. No hard-coding shall be permitted for any FVD operating parameter.

The FVD shall be able to process payments stored in the account linked to the WMATA media, as defined in Sections 3 and 4.

Additionally, the FVD shall be capable of providing all functions available in WMATA's existing environment for customers with all forms of SmarTrip cards. Customers shall be able to add value, check balance, etc. to their SmarTrip card if the card is presented to the FVD. Except for requirements that are NEPP specific, the requirements of this Section 6 shall also apply to SmarTrip cards. Alternatively, if WMATA is presented with a rational and substantiated perspective as to why the FVDs should not meet the above requirements of this paragraph, WMATA will consider other possible resolutions for FVDs. At a minimum, the argument should be based on cost, schedule, technology, and customer acceptance, and be in accordance with the "PROPOSED ALTERNATIVE SOLUTIONS REQUIRING A SPECIFICATION CHANGE" section of the Submittal Requirements.

When installed, the FVD shall meet all ADA requirements.

Customer interface modules, components and processes for all FVD types shall be the same for all FVD configurations. A complete description of the functionality of the FVD shall be provided for WMATA review and approval at each stage of the design review (CDR, PDR, FDR) with the final document fully describing the operation, capabilities, and functionality of the FVD. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 6-1**

6.1.1 Fare Vending

The FVD shall be able to vend all of the fares identified in Section 3.

FVDs shall support the control of WMATA Smart Media stock identified in Section 3 whether issued in accordance with the requirements of this specification, or alternatively issued mis-encoded, jammed, or otherwise unfit for Customer usage. FVDs shall be designed to provide self-clearing functions, to include clearance of coin, currency and Smart Media jams.

The Contractor shall provide a complete description of each FVD type's physical characteristics including all materials, finishes, components, module details (manufacturer, model number, software/firmware version), dimensioned drawings, exploded drawings and other information to permit WMATA to understand which specific items of hardware are being used within each FVD type and their configuration. **CDRL 6-2**

All configuration and parameter settings shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 6-3**

6.1.2 Payment Media Acceptance

FVDs shall be able to accept as payment:

- Widely circulated versions of all valid U.S. currency ($1, $5, $10, $20, $50, and $100 bill denominations with acceptance of accepted denominations settable by WMATA);
- Certain valid U.S. coins (nickels, post 1964-issued dimes, post 1964-issued quarters, post 1978-issued dollar coins);
- WMATA-issued Smart Media;
- PIV cards with credit/debit payment (e.g. American Express, Discover, MasterCard, Visa, etc.) capability;
- Credit cards; and
- Debit cards.

Smart Media types processed and issued by the FVD shall include all those identified in Section 3. The types of currency acceptable shall be configurable via the CDS. All future U.S. currency shall be accepted and bill acceptance shall be upgradable at the device without hardware modification, except in cases where the dimensions of the currency changes.

When the FVD is communicating with the CDS, the Bad Number List stored on the CDS shall be used to reject transactions involving payment media on that list. When CDS communications are not available or transactions cannot be completed within the times identified in Section 3, the Invalid Smart Media List resident in the FVD shall be used. The Positive Number List shall also be used to verify the validity of Smart Media, as applicable.

For conditions when communications with the CDS is lost, the Contractor shall provide a manual procedure with appropriate security to upload data locally. This method shall be via a laptop (or similar device) that will control all fare devices at a mezzanine through the local network connection.

6.1.3 Device Configurability

The FVDs shall be fully configurable such that the functionality shall be able to be defined individually for each FVD, for a defined group of FVDs, and for all FVDs. Different configurations shall be based on the components installed within the FVD. These different configurations shall be utilized to address the specific needs at each installed location. WMATA shall be able to revise any configuration at any time through modification of parameters, activation/deactivation of modules or both via the CDS.

Three distinct configurations of the FVD shall be provided: Full Function FVD, Cashless FVD, and Exit FVD, to meet specific operational needs for a location. The functionalities required by type of FVD are shown in Table 6-1. FVD software shall be modifiable and configurable to permit any function to be provided at any FVD based on the modules employed within the FVD.

Table 6-1 – Fare Vending Device Features

Feature	Full-Function FVD	Cashless FVD	Exit FVD
Accepts cash	✓		✓
Accepts credit/debit media	✓	✓	✓
Replenishes account	✓	✓	✓
Dispenses long-term use contactless media	✓	✓	
Dispenses Limited Use Media	✓	✓	

6.2 Transaction Processing

The FVD shall be able to issue, process and validate fares for Customers as identified in Section 3. For the issue of Smart Media, the following steps shall be employed:

- Customer shall select the fare type based on the selections displayed;
- Customer shall select the Customer category based on the selections displayed;
- Zones of validity shall be selected (if required);
- If the Customer is permitted to select the Smart Media type for the fare to be issued, the selection options shall be displayed:
    - The LUM is issued to the Customer;

    - The WMATA Smart Media is issued to the Customer;

- The account for the Smart Media is updated with the Smart Media validity at the CDS after payment is provided.

All versions of FVD shall provide the Customer with the capability of having their Smart Media read and the validity information for the Smart Media (stored in the account on the CDS) displayed to the Customer when the FVD is on-line and communicating with the CDS. The Customer shall also have the ability to print this information on the receipt stock.

When the Customer is adding value to their Smart Media account at an FVD, the FVD shall permit the Customer to select a pre-identified value to add as well as permitting the customer to enter the exact value to add.

When off-line, the FVD shall be able to vend LUM only until a WMATA-settable threshold value is reached for the vending of LUM. Communication with the CDS shall be required and all data transferred for the threshold value to be reset, permitting the FVD to continue sales. In addition, when off-line the display and printing of transaction history and card usage shall not be available if the transactional information is not stored on the Smart Media.

Each transaction shall be recorded at the FVD and transmitted to the CDS immediately upon communication between the two. Each transaction shall be uniquely identified within the system.

Data to be stored and transferred to the CDS by the NEPP device shall include as a minimum, based on the installed configuration of the FVD:

- All events and alarms sensed;
- All events and alarms cleared, including the identification of the user which cleared the alarm;
- All completed transactions, including payment method, monies inserted, Smart Media serial number, and other data to provide a complete record of the transaction;
- All cancelled transactions, including reason for cancellation;
- All changes in status of the device or any module incorporated;
- All configuration changes;

- The current configuration of the FVD;
- All successful communications;
- All communication failures;
- Electronic serial numbers of all cash containers;
- All power failures and restorations;
- All accesses to the interior of the device;
- All commands received from the CDS;
- All commands issued by the maintenance, revenue service and other personnel; and
- Additional information required to provide a complete audit trail for revenues and Smart Media.

All transaction records shall include, but not be limited to:

- Equipment Number;
- Installation Location;
- Transaction sequence number;
- Transaction value;
- Transaction content (i.e., stored value, pass type, etc.);
- Payment method;
- Payment details (e.g., cash denominations, card information as permitted by PCI);
- Date; and
- Time.

Details for all transaction records shall be provided for review by WMATA at PDR and approval by WMATA at FDR. Sufficient detail shall be provided to permit verification that all required data records and data is included in the data records identified above. **CDRL 6-4**

Full detailed information on all information stored by the FVD shall be provided as a data dictionary at the Conceptual Design Review and updated at the Preliminary and Final Design Reviews. **CDRL 6-5**

The FVD shall be capable of recording locally data representing no less than 50,000 transactions. Each transaction record shall include the date and time of record creation and FVD transaction sequence number.

6.2.1 Payment Methods

For the purchase of Smart Media at the FVD, the following payment methods shall be accepted, based on configuration of the FVD:

- Cash (valid U.S. Currency and coins);
- Magnetic and contactless credit and debit media;
- Value contained in a WMATA Smart Media account;
- Value contained in WMATA Smart Media Accounts linked to authorized new payment technologies such as NFC devices as defined in Sections 1 and 3.

For Full Function FVDs, upon selection of a transaction type, the FVD shall automatically open the apertures for bill and coin acceptance. They shall close only upon the selection of a non-cash payment method or after a pre-determined time-out period.

For purchases using credit cards, the velocity checks as identified in Section 16 shall be performed at the FVD prior to authorization request.

For purchases using debit cards, the velocity checks as identified in Section 16 shall be performed at the FVD prior to authorization request.

6.2.2 Transaction Cancellation

All transactions shall be capable of being cancelled prior to completion either manually by the Customer or automatically by the FVD. To manually cancel a transaction, the Customer shall be able to press a clearly marked “Cancel” button or touch region on the front panel of the FVD. Automatic cancellation of a transaction shall occur under the following conditions:

- A programmable time limit elapses prior to completion of the payment;
- The maximum capacity of bill escrow is exceeded;
- The maximum number of coins for Smart Media payment has been exceeded;
- Power failure prior to completion of transaction, when sufficient funds to purchase the selected Smart Media had not been inserted;
- Conditions during a credit or debit media transaction as indicated in ISO 8583;
- Velocity checks fail (as detailed in Section 16);
- The Smart Media cannot be dispensed due to jamming or mechanical failure;
- The Smart Media cannot be dispensed due to insufficient stock for completion of the transaction;
- A failure occurs and the FVD cannot complete the transaction.

Upon either manual or automatic cancellation:

- A “Transaction Cancelled” message shall be displayed on the display screen;
- Coins and bills in escrow shall be returned to the Customer;
- If a credit or debit media transaction is underway involving the adding of value to an item of Smart Media, a reversal message shall be transmitted to void the transaction in progress. A receipt shall be printed with the cancel/void message if the transaction has proceeded past the point at which credit or

debit media has been used as payment and the receipt can be printed; and

- If stored value is used as a payment method, the FVD shall require the passenger to re-present the stored value Smart Media for replenishment.

Should monies inserted for the transaction fail to be returned for a cancelled transaction, prior to the automatic shutdown of the FVD, the following shall occur:

- If the FVD can print a receipt, then the refund voucher shall be issued to the passenger with the total monies inserted and the transaction number; and

- If the FVD cannot print a receipt, a refund voucher number shall be displayed for the passenger to transcribe. The message shall be displayed for a user settable time from 15 to 120 seconds.

These vouchers shall be managed using the Voucher Management software as identified in Section 16.

If multiple Smart Media are being purchased and a failure occurs prior to the completion of issuance of the Smart Media, all payments shall be completely processed/accepted and a transaction record stored identifying the value of the Smart Media, as well as the types of fares not issued. A voucher shall be prepared and:

- If the FVD can print a receipt, then the refund voucher shall be issued to the passenger with the value of the unissued tickets and the transaction number; and

- If the FVD cannot print a receipt, a refund voucher number shall be displayed for the passenger to transcribe. The message shall be displayed for a WMATA-configurable time from 15 to 120 seconds.

Conditions under which a transaction shall not be capable of being cancelled manually shall include:

- Cash transaction for which full payment for the purchase or reload has been tendered;

- Credit or debit media transactions for which clearinghouse authorization for the transaction has been received by the FVD.

The FVD shall be ready for processing the next transactions within 5 seconds of the cancellation (under normal operating conditions, when no more than 10 coins and 5 bills have been inserted, and including the inter-transaction time-out).

Information to be printed on vouchers and receipts shall be presented to WMATA for review purposes at the PDR and for approval purposes at the FDR. **CDRL 6-6**

6.2.3 Transaction Speeds

Transaction speeds for the FVD sales transactions using various payment methods shall be as described below.

For all transactions, the time between the completion of the transaction (when the Smart Media is deposited in the media/coin return bin and the Smart Media account has been identified as updated as a final step). The FVD's readiness to begin another transaction shall not exceed 5 seconds (including the inter-transaction time-out).

6.2.3.1 Cash Transactions

The time required to complete the sample cash transactions listed below shall not exceed the values presented in Table 6-2 provided that:

- All inserted coins and bills are inserted at maximum possible speed;
- All inserted coins and bills are accepted on the first insertion;
- All transactions are for the purchase of a single item of Smart Media.

Table 6-2 – Maximum FVD Transaction Times

Sample Transaction Content	Maximum Time to Complete
One bill inserted Two coins returned	12 seconds
Four coins inserted Two coins returned	14 seconds
Two bills inserted Four coins returned	15 seconds
One bill inserted Four coins inserted Two coins returned	17 seconds
Five bills inserted Four coins returned	25 seconds

Where possible, FVD speed for completion of the transaction shall be optimized by the use of concurrent activities such as:

- If a canceled transaction requires the return of coins and bills, both the coin and bill systems shall be commanded to do so simultaneously.

6.2.3.2 Bank Card Transactions

Transaction times for bank card transactions shall not exceed the following times (excluding PIN entry time and clearing house processing time):

- When the CDS interface with the acquirer is on-line: 5 seconds;
- When the CDS interface with the acquirer is inactive, including the attempt to establish communications: 10 seconds.

6.2.3.3 Smart Media Transactions

Transactions shall occur in no more time than is defined in Section 3. The processing shall include checking of all data, including a maximum-sized Invalid Smart Media List review, performing the necessary computations, and storing all data as required. It is understood that some Smart Media transactions may require multiple "tags" of the card to the reader. In such cases, the second "tag" shall not be considered for the purposes of transaction speed calculations.

6.2.4 Alarms and Events

Events, which result in a change of service status or a problem of any kind with the FVD, shall be reported to the CDS via the network, in real time, and shall also be recorded at the FVD.

In cases of network failure, the FVD shall have sufficient capacity to store, at a minimum, ten days' event and transaction data. This information shall be stored in both the FVD main memory and in non-volatile memory. A portable data unit shall be able to be used to extract the data from the FVD memory and transfer it to the CDS.

Upon successful re-connection of network operations, all stored transaction data (e.g., alarm, event, sales) shall be automatically transmitted to the CDS. When populating this information to the NEPP data base, if the record exist, due to the fact that the portable data unit transferred the data, the record shall not be overwritten if the data is exactly the same. If there is any difference between the two transaction records, the transaction record stored first shall remain and the second record shall be identified in an exception file with these differences highlighted.

6.3 User Interfaces

6.3.1 Customer Display

The Customer Display shall be a minimum 15-inch diagonal, active matrix color, trans-reflective liquid crystal display,. The display shall be mounted at an angle that maximizes the ability of Customers to read the screen while at the same time ensuring that the alignment of any line/arrows to adjacent selection buttons (if utilized) leaves no doubt as to what text or graphic on the screen is associated with each button. Should a touch screen be provided (see Section 6.3.2), the visibility and performance of the Customer Display shall not be adversely affected.

The display shall be capable of displaying in no less than 256-color graphics, and provide for fully programmable graphics for the entire viewable surface of the screen. The minimum resolution shall be 1024X768 dpi.

The display shall have a non-glare finish that can be easily read at all ambient light levels, including direct sunlight. The display shall produce a minimum of 1,000 nits brightness with at least a 750:1 contrast ratio.

The display shall be of industrial or military grade. It shall be vandal resistant, able to withstand direct blows as defined in UL certification testing. If an overlay is utilized its light transmission shall be 90% or greater.

The display shall incorporate a “screen saver” function in a standard movie format (e.g., mpeg, AVI). This screen saver shall be able to be modified, replaced and/or deactivated by WMATA without assistance from the Contractor or its representative. Settings for the screen saver shall also be able to be modified by WMATA and shall include the time required for activation of the screen saver based on time of inactivity at the FVD.

All displayed information and screen layouts for all transactions and messages shall be provided to WMATA at the Preliminary, and Final Design reviews for WMATA review and approval. **CDRL 6-7**

6.3.2 Customer Selection Methodology

Customer selections shall incorporate one of two methods for interaction with the FVD:

- Touch-screen; or
- Programmable soft buttons adjacent to and dynamically defined, no less than five on each side (left and right) of the display screen.

Using either of these selection methods, Customers shall be able to perform and complete their transaction. As each selection is made, the display screen shall update to show only those options available for selection based upon the Customer selections and FVD operating status. All selections shall provide an audible tone, per Section 6.3.3, upon being selected.

Touch screens, if incorporated, shall not be adversely impacted by operation in an outdoor, unsheltered environment. The screens shall be sealed and otherwise protected so that the sensitivity and operation of the screen is not adversely affected by environmental conditions as identified in Section 2. Touch screen usability shall be unaffected by Customers wearing gloves or using a prosthesis.

The FVD shall incorporate dynamically defined menus to accommodate all requirements of the WMATA system. When the same function appears in several screens, its location shall be consistent among all selection screens. At least ten selections shall be available for each displayed screen.

Certain functions shall be implemented in pre-defined pushbuttons that are always functional while the FVD is in service:

- One VOICE message pushbutton which, when depressed, shall cause message(s) to be annunciated to the Customer.
- One CANCEL pushbutton which, if activated before the correct fare has been inserted, shall cancel the fare category selected, return monies inserted, deactivate the voice message system (if activated), and restore displayed messages to English (if another language had been selected). No Customer-initiated cancellation of the transaction shall be possible once Smart Media printing or Smart Media encoding commences.

If the FVD utilizes a touch screen interface, these functions may also be provided by touch regions that remain consistent on every screen where the functionality is relevant.

6.3.3 Audible Tones

The FVD shall, in accordance with ADA requirements, emit a unique tone to provide audio feedback to the Customer each time any button is pressed and during circumstances where additional Customer input is required to complete the transaction. The volume of the tones shall be field-adjustable, and shall be audible in all station environments.

An audible tone shall be provided for the acceptance and processing of valid Smart Media. A second audible tone shall be provided for an unsuccessful transaction or upon the presentation of invalid media.

6.3.4 Voice Instructions

Each FVD shall be designed for normal operation with voice instructions in English. WMATA, however, requires that the FVDs shall be deployed with the following languages:

- English;
- Spanish.

The FVD shall have the functional expandability to accommodate not less than four (4) additional languages. WMATA shall select these additional languages prior to CDR. When these additional languages are activated, screens, audio and graphics shall be provided in these activated languages.

The FVD voice instruction functionality shall be provided using a text to speech system, rather than stored audio messages. The voice instruction system shall support both SAPI4 and SAPI5 interfaces, and work within any Microsoft Windows® based speech application. Contractor shall provide the selection of voices for WMATA review at PDR and selection at FDR. **CDRL 6-8**

The FVD voice instructions shall normally be switched "off" until activated via the press of a VOICE button by a Customer. Once activated, the voice instruction system shall play audio instructions in concert with the visual messages and selection options that are displayed, and as necessary, describe FVD actions that have occurred which require a Customer response. Volume control shall be provided to the Customer through the use of the Customer controls on the face of the FVD.

Until the information on the entire screen has been annunciated for the Customer, the displayed information shall not change due to transaction timeout or for other similar reasons, unless action has been taken by the Customer via selection of a subsequent function or depression of a button. When voice instructions are active, the intra-transaction timeout shall not commence until all voice instructions for a screen are complete.

Voice instructions shall be terminated with cancellation of the transaction, completion of the transaction or through the depression of a button on the face of the FVD, based on instructions provided to the Customer. The VOICE message pushbutton may be used for both the volume control as well as for the deactivation of the voice instructions, subject to clear and concise audible instructions being provided to the Customer.

6.3.5 Instructional Graphics

An information display shall be provided on the face of the FVD to display instructions to the Customer on how to operate the FVD. The sequence of steps shall be clearly indicated by the use of graphics and symbols.

Instructions and graphics shall be designed to minimize glare and other effects of sunlight and ambient lighting that could otherwise reduce the readability of the instructions on the FVD.

A conceptual description of instructional graphics shall be submitted for WMATA review and approval at the Preliminary Design Review. **CDRL 6-9**

6.3.6 Service Indicator Light

FVDs shall have a visible service status indicator light on the cabinet that shall display the need for service. The service indicator light shall be as high on the cabinet as possible and shall be visible from the front of the cabinet.

6.4 FVD Report Printing

Each FVD shall provide reports that shall be printed upon request for WMATA Revenue Service staff using the receipt stock, available within each FVD. All reports shall include:

- FVD ID number;
- Date and time of report printing; and
- ID of individual generating the report.

At a minimum, the following reports shall be provided:

- Cash Container Contents – report listing the contents by denomination of a cash container. Information provided on each report includes, but is not limited to:
    - Cash container ID number;
    - Date/time installed or removed (as applicable);
    - ID of the individual performing the exchange (as applicable);

- Contents of the container: subtotal by denomination and total.

This report shall be created and stored for transfer to the CDS automatically when a cash container is removed or inserted.

- Cash Container Removed or Inserted – report including:
  - Cash container ID number;
  - Date/time installed or removed (as applicable);
  - ID of the individual performing the exchange.

  This report shall be created and stored for transfer to the CDS automatically when a cash container is removed or inserted. Based upon a WMATA-settable parameter, upon removal or insertion of a cash container, the FVD receipt printer shall automatically print this report.

- Equipment Status Report – report indicating the operational status of all modules. If a module is inoperative or operating in a degraded mode, the report shall list the error condition and the date and time the condition occurred.

- Stock Report – report indicating the details of the Smart Media within an FVD, as well as any media exchange activity, including prior and new serial number series, the stock remaining for each installed stock, spoiled/jammed Smart Media serial numbers and the contents of the reject bin (see Section 6.8).

- Media Failure Report – report detailing for the Smart Media stocks installed all partially-printed, non-printed, jammed, non-encoded, ”torn” and mis-encoded Smart Media and total number of media sold in the same period; between failure events and the contents of the reject bin (see Section 6.8).

- Error Logs – report identifying the last twenty (20) errors that occurred at the FVD. Each error log shall include the specific error code, description, the date and time that this error occurred and shall identify if the error has been cleared.

- Credit and Debit Error Log – report identifying the last twenty (20) credit & debit rejection codes which have occurred.

- FVD Close-Down Reconciliation – report that is summarized for the FVD by payment method and sales category depicting the total sales, expected bill and coin vault contents, actual counts for recirculating coin units, coin vaults, coin hoppers and the Smart Media remaining for each installed stock. Access to this report shall be restricted to WMATA staff with supervisory status or higher.

Format and content of each report shall be submitted to WMATA for review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 6-10**

6.5 Smart Media Control

The FVD shall provide control of all Smart Media and receipt stock within the FVD. This shall include accounting for Smart Media loaded into the FVD but not sold.

As part of the daily close/open processing the FVD shall capture the current (sequential) inventory control number for each of the stocks based on the information entered when stock is loaded.

The FVD shall provide a mechanism to account for unused Smart Media within the FVD and for setting the starting and ending inventory control numbers of the new stock. Additionally, personnel shall be able to enter the Smart Media inventory control numbers of any spoiled/unused Smart Media.

When there is a jam involving any of the feed mechanisms, the FVD shall retain the number of the last item of Smart Media issued from that feed. Smart Media maintenance activities shall always conclude with the generation of a Stock Report as identified in Section 6.4

6.6 Bill Processing System

The bill processing system shall be a unit that has been proven in revenue service and be comprised of the following elements:

- A bill acceptor that shall validate U.S. currency notes inserted by Customers;
- An escrow assembly to hold inserted notes until completion of a transaction; and
- A secure bill vault to house the authenticated currency.

Access to the bill acceptor and escrow shall be possible without access to the vault. Access to both the validator and escrow assemblies shall be electronically monitored, creating and sending an event transaction to the CDS for each access.

The bill processing system and its components shall be capable of remote configuration, re-initialization, and diagnosis of malfunctions. All specified diagnostic and operational reports that are available at the assembly shall also be attainable through the CDS.

6.6.1 Bill Acceptor

The Bill Acceptor shall be configurable to accept any U.S. Currency denomination and version, with initial acceptance of currency in general circulation at the time of Final Design Review, in the following denomination of U.S. Currency notes: $1, $5, $10, $20, inserted in any of the four possible length-wise directions.

The Bill Acceptor shall accept at least 13 different versions of bills. (A "version" shall consist of a denomination of a certain design.) The Contractor shall provide a method and procedure, as well as any required special tools, to enable WMATA, without Contractor assistance or intervention, to reconfigure the bill acceptor to accept and verify future general circulation U.S. currency. These software updates for future currency shall be downloadable from the CDS and installable into the Bill Acceptance System without hardware exchange or modification.

All bills inserted for fare payment shall enter through a single entry slot sized and formed to permit easy insertion of bills. Bills shall be verified and authenticated through utilization of light or magnetic measurement techniques. Bills detected as invalid shall be rejected and immediately returned to the Customer.

A mechanical shutter shall secure the bill slot between transactions. The bill slot shall automatically open when the cash transaction has reached the point of requesting cash payment. It shall remain open once cash has been inserted until full payment has been received. If the Customer selects a non-cash form of payment, the bill slot shall automatically close and remain closed until the next transaction that requires it to be ready to accept payment. The bill acceptor shall utilize distinct visual and audible indications to assist Customers in determining when the acceptor is ready or not ready to receive bills.

The bill acceptor shall transfer each accepted bill to the bill escrow.

Acceptance Rate

The bill acceptor shall meet the following acceptance rates for bills in street condition:

- 98% of valid bills shall be accepted upon initial insertion
- 95% of valid bills rejected on the first insertion shall be accepted upon one reinsertion

The acceptance rate (AR) is defined as follows:

$$AR = \frac{I - R}{I}$$

where: I = Total number of valid bill insertions

R = Total number of valid bill rejections

This acceptance rate shall be ensured by a self-adjusting system, which accounts for differences between banknotes in circulation caused by production variances and unique aging characteristics. All counterfeit U.S. currency and all foreign currency shall be rejected

Bill Accuracy

The bill acceptor shall identify valid acceptable bills with at least 99.99% accuracy for bills in street condition. Accuracy (A) is defined as follows:

$$A = \frac{V - M}{V}$$

where: V = Total value of bills accepted

M = Total value of incorrectly identified bills

6.6.2 Bill Escrow

The bill escrow shall hold a minimum of 15 bills; the Bill Processing System shall encash escrowed bills to the bill vault only when the transaction has been successfully completed. If the transaction is not completed for any reason, the escrowed bills shall be returned to the Customer in a single action.

Bills in escrow shall not be affected by rejection of a bill by the acceptor. Escrowed bills shall be returned to the Customer upon any one of the following actions, which shall be easily configurable by WMATA:

- Customer-generated or machine-generated cancel command;
- Expiration of the programmable preset time limit for completion of the transaction;
- Component required for completion of the current transaction fails; and
- FVD fails before completion of the transaction and goes into "Out of Service" mode.

Upon successful completion of a transaction, all bills in the escrow shall be deposited into the bill vault.

6.6.3 Bill Vault

A secure, serialized (both electronically encoded, and visually displayed from the outside) bill vault shall be provided. The bill vault shall automatically and neatly stack all accepted bills. The minimum capacity of the bill vault shall be 2,000 U.S. currency notes.

Whenever it is removed from the FVD, a fully loaded bill vault shall weigh no more than 25 pounds and be easily transportable. Bill vault shall not distort when fully loaded. When dropped to a concrete floor on any corner or side from a height of not less than three (3) feet, the full bill vault shall suffer no operational impediments and maintain security.

The bill vault shall be able to be installed in a single orientation only. If a bill vault is not properly installed, the FVD shall be inoperable and shall not be able to be placed into service. Removal and reinsertion of the same bill vault into the FVD shall place the FVD in a fault condition, sending an event immediately to the CDS, and the FVD shall not be placed into service. The NEPP shall include a parameter settable from the CDS which enables the FVD to accept the reinsertion of the same bill vault.

Removal of the bill vault shall automatically:

- Generate, in electronic and paper form, revenue service audit reports identified in Section 6.4

- Reset the bill vault count(s) within the FVD to zero
- Transmit an event to the CDS

Insertion of a different bill vault shall automatically:

- Generate, in electronic form and paper form, revenue service audit reports identified in Section 6.4
- Transmit an event to the CDS

6.7 Coin Processing System

The FVD shall accept and dispense coins using an integrated system of modules and subsystems, including the coin slot, coin acceptor, coin escrow and coin vault.

All coin processing system components shall be designed to withstand regular removal, replacement, and normal handling in a transit-operating environment without deformation, or in any way interfering with the insertion and removal process.

The FVD shall automatically detect the presence or absence of each coin processing system component and the type of coins contained in each component.

The coin escrow shall be able to verify and hold a minimum of 30 coins of any combination of denominations before canceling the transaction and returning all deposited funds. The maximum number of inserted coins permitted before the transaction automatically cancels shall be configurable at the CDS.

The removal and reinsertion of the same coin storage container into the FVD shall place the FVD in a fault condition, immediately send an event to the CDS, and require entry of a supervisory PIN to clear the alarm and place the FVD into service.

6.7.1 Coin Slot

The coin slot shall be stainless steel, shall be located on the FVD door, and shall be precisely matched to the coin acceptor assembly. The coin slot bezel shall not be part of the coin acceptor.

A mechanical shutter shall secure the coin slot between transactions. The coin slot shall automatically open for cash transactions, and shall close when electronic payment options are selected.

An accurate, replaceable, full-size graphical representation of each accepted U.S. coin shall appear above the coin slot. The coin slot shall be sized to prevent simultaneous insertion of any two (2) valid U.S. coins side-by-side as well as US Kennedy half-dollar coins.

6.7.2 Coin Acceptor

The FVD coin acceptor shall accept and count the value of U.S. nickels (5¢), dimes (10¢), quarters (25¢), and dollar coins ($1.00). Dollar coins accepted and processed shall be those minted and issued commencing in 1979.

The coin acceptor shall have a serialized number that is visually readable upon its removal from the FVD.

Each coin shall be verified using a process that considers metallic content and other characteristics of the coin.

The coin acceptor and associated logic shall be capable of being programmed to accept at least four additional coin types of different electronic profiles and shall not require replacement or remanufacture of the coin acceptor or other FVD hardware. In addition, each FVD shall be capable of being individually configured to accept or prevent the acceptance of each of the above identified coins.

The Contractor shall provide a method and procedure, as well as any required special tools, to enable WMATA to reconfigure the coin acceptor software and hardware to accept and verify future coins.

Verification shall be accomplished through comparison of the inserted coins to stored standards for coins of the same denomination set by the U.S. Mint for those coins in general circulation. Rejected coins shall be returned to the Customer.

Acceptance Rate

The coin acceptor/verifier shall meet the following acceptance rates:

- 98% of valid coins shall be accepted upon initial insertion.
- 95% of valid coins rejected on the first insertion shall be accepted upon one reinsertion.

All known counterfeit coins, common slugs, foreign coins, and coins of denominations not accepted by the FVD shall be rejected upon every insertion.

The acceptance rate (AR) is defined as follows:

$$AR = \frac{I - R}{I}$$

where: I = Total number of valid coin insertions

R = Total number of valid coin rejections

Coin Accuracy

The coin acceptor/verifier shall identify valid acceptable coins with at least 99.99% accuracy. Accuracy (A) is defined as follows:

$$A = \frac{V - M}{V}$$

where: V = Total value of coins accepted

M = Total value of incorrectly identified coins

6.7.3 Coin Escrow

The coin escrow shall hold a minimum of 30 coins; the Coin Processing System shall encash escrowed coins to the coin vault only when the transaction has been successfully completed. If the transaction is not completed for any reason, the escrowed coins shall be returned to the Customer in a single action.

Coins in escrow shall not be affected by rejection of a coin by the acceptor. Escrowed coins shall be returned to the Customer upon any one of the following actions, which shall be easily configurable by WMATA:

- Customer-generated or machine-generated cancel command;
- Expiration of the programmable preset time limit for completion of the transaction;
- Component required for completion of the current transaction fails; and
- FVD fails before completion of the transaction and goes into “Out of Service” mode.

Upon successful completion of a transaction, all coins in the escrow shall be deposited into the coin vault.

6.7.4 Coin Vault

A secure, serialized (both electronically encoded, and visually displayed from the outside) coin vault shall be provided to accept overflow of coins. Coin vaults shall be located within the FVD to facilitate easy and rapid exchange by revenue service personnel.

The coin vault shall have a minimum capacity of 225 cubic inches.

The coin vault shall be secure, of sturdy construction, and manufactured from stainless steel or another WMATA-approved material.

The operation of the coin vault shall be such that it is secure, with no openings when it is removed from the FVD. Removal of the coin vault shall automatically:

- Generate, in electronic and paper form, revenue service audit reports identified in Section 6.4;
- Reset the coin vault count within the FVD to zero;
- Transmit an event to the CDS.

Insertion of a different coin vault shall automatically:

- Generate, in electronic and paper form, revenue service audit reports identified in Section 6.4;
- Transmit an event to the CDS.

Coin Vaults shall position correctly in a single orientation, and the FVD shall accept no coins if a vault is not properly positioned. Coin vaults shall not distort when fully loaded. The coin vaults either fully loaded or empty when dropped to a hard floor from a distance of 36" shall not suffer any operational impediments or security breaches.

6.8 Smart Media Dispenser

The FVD shall vend Smart Media to Customers using a Smart Media Dispenser. This dispenser shall not print on the WMATA Smart Media. but shall print on LUM as required. At least two (2) stackers for the WMATA Smart Media shall be provided within the FVD. Each

stacker shall have a capacity of not less than four hundred (400) pieces of WMATA Smart Media.

The Smart Media Dispenser shall verify encoding on all Smart Media prior to dispensing. The Smart Media Dispenser shall read the chip ID number and store the number as part of the transaction record. The FVD shall transmit the transaction record to the CDS immediately upon successful completion of the transaction.

Smart Media which is unable to be issued due to a material or encoding defect shall be deposited in a reject bin with capacity of not less than 30 pieces of WMATA Smart Media. A counter shall be provided so that when the bin nears a WMATA-settable capacity it shall send a message to the CDS so that revenue servicing can occur. If capacity is reached before revenue service is performed, the FVD shall disable sales of new Smart Media and send an alarm to the CDS. The Smart Media Dispenser shall include sensors to detect low and empty conditions of each Smart Media stock. Upon detection, the FVD shall report such conditions as events to the CDS. These levels shall be settable by WMATA at the CDS.

Smart Media shall be replenished in whole bundles only. When Smart Media inventory is replenished in an FVD, the FVD shall prompt the service technician to enter the serial number of the bundle. The FVD shall transmit this information to the CDS, which shall then update the database to reflect the location of all Smart Media in the bundle accordingly.

The stackers shall operate independently of each other, enabling the FVD to dispense at least two distinct Smart Media designs. Stackers shall permit one stack to back up other stacks so that Smart Media dispensing continues in the event of one stack being depleted.

6.9 Limited Use Media Dispenser

The FVD shall include one or more Limited Use Media Dispensers to dispense Limited Use Media (LUM). The LUM Dispenser shall print information onto the LUM prior to dispensing.

The LUM Dispenser shall dispense from at least two rolls or fan-fold stacks; each roll or fan-fold stack shall be as described in Section 3.

All LUM shall be dispensed as individual items; the LUM Dispenser shall include the necessary components to cut or separate individual LUM items prior to dispensing.

The LUM Dispenser shall print information onto the LUM upon issuance using direct thermal technology. Information to be printed shall include, but not be limited to:

- Date and time of purchase;
- FVD number;
- Account type (stored value account, pass account);
- Initial account value (if applicable);
- Pass type and duration (if applicable).

The Smart Media Dispenser shall verify encoding on all LUM prior to dispensing. The LUM Dispenser shall read the chip ID number and store the number as part of the transaction record. The FVD shall transmit the transaction record to the CDS immediately upon successful completion of the transaction.

Limited Use Media which is unable to be issued due to a material or encoding defect shall be deposited in a reject bin with capacity of not less than 100 pieces of LUM. A counter shall be provided so that when the bin nears a WMATA-settable capacity it shall send a message to the CDS so that revenue servicing can occur. If capacity is reached before revenue service is performed, the FVD shall disable sales of new Limited Use Media and send an alarm to the CDS. The FVD shall provide a service command to permit authorized service technicians to reset the reject bin counter.

The LUM Dispenser shall include sensors to detect low and empty conditions of each roll or stack. Upon detection, the FVD shall report such conditions as events to the CDS.

Limited Use Media shall be packaged as described in Section 3, and shall include an inventory tracking number for each roll or stack. Limited Use Media shall be replenished in whole rolls or stacks only. When LUM inventory is replenished in an FVD, the FVD shall prompt the service technician to enter the serial number of the roll or stack. The FVD shall transmit this information to the CDS, which shall then update the database to reflect the location of all Limited Use Media in the roll or stack accordingly.

The rolls or stacks shall operate independently of each other, enabling the FVD to dispense at least two distinct LUM designs. The LUM Dispenser shall permit one roll or stack to back up other rolls or stacks so that Limited Use Media dispensing continues in the event of one roll or stack being depleted.

6.10 Payment Processing Target

The FVD shall incorporate a Payment Processing Target (PPT) as described in Section 3.

6.11 Receipt Printer

A separate receipt printer shall print Customer receipts and audit reports. The receipt printer shall be able to print all alphanumeric characters in both upper and lower case, and graphics. Printed characters shall be produced with a minimum height of 0.12 inches. The approximate height to width ratio of the characters shall be 5:3. The printer shall be of the direct thermal type.

Customer receipts shall be at least 2 inches by 4 inches, shall clearly indicate that the document is a receipt and not a valid item of Smart Media, and shall contain information identified in Federal Regulation E and Z and as required by WMATA.

A receipt shall be available for all FVD transactions. The Customer shall be provided with the opportunity to request a receipt at the end of their transaction.

In addition, for the credit and debit card transactions above the receipt-requirement thresholds, a receipt shall always be issued and this receipt shall meet all PCI DSS and Federal requirements. If there is no receipt stock available, the Customer shall be required to choose to complete a transaction without issuing a receipt or the transaction will be cancelled.

Receipts shall be deposited in the media/coin tray within three (3) seconds after the Customer responds affirmatively to the prompt requesting whether a receipt is desired.

6.12 Media/Coin Tray

The opening for the media/coin tray shall be recessed and covered with a clear polycarbonate spring-loaded or weighted door that opens inward, and which does not present a pinching hazard when opened and closed by Customers. The door shall be at least 0.25 inches thick and completely cover the opening when closed.

The tray and its door shall be robust, scratch-resistant, and visually prominent. The geometry of the tray and its door shall minimize intrusion into the FVD by foreign objects while the media/coin return tray door is open. The tray shall be designed to drain any liquids placed in the tray to the outside of the FVD.

As soon as a Customer has completed payment for a transaction, or a transaction is canceled that results in coins being deposited in the media/coin tray, a light in the media/coin tray shall illuminate. The media/coin tray light shall remain lit for a WMATA-adjustable period after all Smart Media and coins have been deposited there by the FVD, or until the next transaction is initiated, whichever occurs first.

6.13 Bank Card Processing

To process credit and debit cards, a bank card processor shall be incorporated into the FVD for Customer payment of fares. The components which make up the bank card processor are the PPT, PIN Pad and the magnetic bank card reader.

6.13.1 PIN Pad

In addition to the Customer selection buttons, a PIN Pad shall be provided to support electronic payment transactions and to provide an alternative means of Customer selection to meet ADA requirements.

The PIN Pad shall conform to ISO/IEC and ANSI X.29 requirements for data entry equipment and encryption. The PIN Pad shall also adhere to applicable security standards (Sections 2 and 4) and support operation in both clear and encrypted mode.

Buttons necessary to support electronic payment transactions (as defined by banking industry standards) shall be provided. All letters, numbers, symbols, and words on keys shall be wear and fade resistant.

The PIN Pad shall be spill and dust resistant.

PIN Pads shall employ tactile and audio feedback, in accordance with ADA requirements. PIN Pad shall also employ methods, visual and audible in concert with the Customer display to indicate to the Customer that their action has been recognized as either accepted or rejected.

6.13.2 Magnetic Bank Card Reader

The FVD shall include the capability of accepting magnetic credit and debit media as payment for transactions. The bank card reader shall be a dedicated, commercially available “dip-insertion” type reader.

The bank card reader shall be able to read, translate, and transmit complete Track 1 and 2 data in accordance with ISO/IEC and ABA standards. Software for bankcard readers shall be in accordance with ANSI, ISO and ABA standards for data encryption.

6.13.3 Contactless Bank Card Processor

Contactless bank cards shall be processed by the PPT, as identified in Section 3.

6.14 Control System

Each FVD shall be equipped with an Electronic Control Unit (ECU) to control, store, coordinate, supervise, and respond as appropriate to the status, operation, security, and accounting of all FVD functions.

The ECU shall cause the display screen to display information that is to be displayed in response to Customer input. For example, upon selection of a fare, the display screen shall react instantaneously by displaying the transaction selected and amount due.

6.14.1 ECU Hardware

The ECU shall be based on a commercially available microprocessor system of current manufacture equipped with, at a minimum::

- A microprocessor with adequate processing speed for the type of service for which it is intended.

- Adequate random access memory for operating program(s) and other temporary needs. The ECU shall have sufficient RAM to avoid the use of virtual memory (*i.e.,* a hard disk) as a means of temporarily supplementing RAM during normal FVD activities. Provision shall be furnished to permit plug-in upgradeability to double the amount of memory initially supplied.

- Non-volatile memory device(s) for operating system and application software. The primary copy of configuration and operating data shall be stored on the non-volatile memory device(s). Capability shall be provided to exceed initial storage requirements by at least 200%.

- An interface for removable read/write storage media as required for software upgrades and data transfers.

- Keypad and display for entry of commands to retrieve, display, and print diagnostic, status, accounting, and registration data locally at the FVD.

- Ethernet and other communications interfaces as required to support external communications.

- A “watchdog” timer circuit that automatically initiates an orderly operating system restart in the event of a software-induced failure such as a total suspension of all activities.

- The FVD shall be capable of detecting basic internal malfunctions. The malfunction detection shall cover at least failure of power or control circuitry, opening of an access panel, and any failure of any Smart Media unit that could result in a false, incomplete, or corrupted reading of a Smart Media. The information displayed shall indicate the type of failure that caused the machine to shut down.

6.14.2 Data Memory

All data corresponding to sales, cash container contents, Smart Media inventory, FVD status, and diagnostics shall be stored in the data memory for accounting and registration, and shall be processed to accommodate the requirements of the NEPP System. Non-volatile data storage shall be provided for accounting, registration, and event data; the contents of these registers shall be updated with each transaction or event. A second copy of the contents of the non-volatile data registers shall be stored on the removable solid-state memory module. All FVD sales, status, and event data shall be successively and safely registered, even if a power failure occurs.

6.14.3 ECU Clock

The ECU shall contain electronic clock functionality. The clock shall be used to generate time signals to maintain accurate records. The clock shall also contain calendar data to determine year, month, and day including leap year without manual intervention. Automatic correction for time changes between standard and daylight savings time shall be provided. The clock shall reset with the correct time each time communication is successful with the CDS, which shall occur at least once per day.

6.14.4 Time-Out Operations

As described below, the FVD shall provide WMATA-adjustable time-out periods to return the FVD to the idle state in prescribed times between steps of a transaction and between transactions. Other time-out periods, as applicable to the transaction process, shall also be adjustable by WMATA.

6.14.4.1 Intra-Transaction Time-Out

An intra-transaction time-out function shall be provided which shall limit the time between successive steps of any transaction. The timer shall start after selection is commenced, and shall reset and re-start after each Customer input or insertion of a coin or a coin, presentation of Smart Media or bank card to the PPT, or insertion of a bank card in the bank card reader.

While the voice message system is active, the intra-transaction time-out countdown shall commence only after the entire voice message is played for the current transaction step.

The intra-transaction time-out shall be initially set to 30 seconds and shall be adjustable by WMATA from 1 to 90 seconds in increments of 1 second.

6.14.4.2 Inter-Transaction Time-Out

Similar to the intra-transaction time-out described above, an inter-transaction time-out shall also be provided. This timer shall limit the amount of time the FVD waits after completion or cancellation of a transaction (except as noted below) before resuming the idle state.

While the voice message system is active, the inter-transaction time-out countdown shall commence only after the entire voice message is played for the end-of-transaction screen. The inter-transaction time-out shall be initially set to 5 seconds and shall be adjustable by WMATA from 1 to 30 seconds in increments of 1 second.

6.14.4.3 Idle Screen Time-Outs

Two distinct time-outs shall apply while the FVD is displaying the idle screen.

- Alternate Language Time-Out. If a Customer selects an alternate language while the FVD is displaying the idle screen but takes no further action for a WMATA-adjustable period, the FVD shall revert to English. This time-out shall be adjustable from 1 to at least 120 seconds in increments of 1 second, and shall be initially set to 30 seconds.

- Screen Saver Time-Out. After a WMATA adjustable period displaying the idle screen, the FVD shall display a screen saver. The screen saver time-out shall be adjustable from 1 minute to at least 90 minutes in increments of 1 minute, and shall initially be set to 5 minutes.

6.14.4.4 Bank Card Authorization Time-Out

The FVD shall also include a separate time-out parameter to define the time allowed for a response from the CDS for bank card transaction authorization. This parameter shall be initially set to 20 seconds, and shall be adjustable by WMATA in the range of 1 to at least 90 seconds.

6.14.5 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's memory for later transfer. 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 modifiable by WMATA at the CDS.

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

6.14.6 Alarm Unit

Each FVD shall be equipped with an alarm unit, which shall monitor FVD security conditions and report security breaches. The alarm unit shall monitor the security status of the FVD independent of the ECU; if the ECU is disabled for any reason, the alarm unit shall continue to operate and monitor the FVD for security breaches and impacts. Each time that the alarm is activated, the service indicator light shall be activated and shall remain active until manually cleared by authorized WMATA personnel.

Each FVD shall be equipped with an internal alarm mechanism that shall provide a clearly audible sound (the level shall be programmable by WMATA) in the event of tampering or unauthorized intrusion. Each FVD shall additionally have the capability to be linked through the use of a dry contact relay to an external security system.

The FVD alarm unit shall:

- Detect status of the outer door lock and the opening of the outer door by switch, optical detector, or other means.
- Detect and report pending and active security breaches to the ECU when the ECU is operational.
-
- Be equipped with an electronic siren that shall be capable of emitting a sound level of at least 110 dB(A) measured at a distance of three feet with the door open. Whenever the siren is sounding, the FVD shall go out of service, and the Service Light shall be activated. When the siren is silenced, the FVD shall perform self-diagnostics and if possible, resume normal operations.

Each time the FVD is secured, the alarm unit shall reset and resume monitoring FVD security. Each time a security breach or impact is detected and the ECU is operational, an event record of the activation with date and time shall be immediately created, stored, and reported to the CDS.

The alarm unit shall be normally powered by commercial power. When commercial power is not available, the backup power system identified in Section 6.14.8 shall be used. During power outages, the alarm unit shall utilize the backup power system to continue to monitor the security status of the FVD. The duration of the annunciation of the security alarm shall be settable by WMATA for each security event from one (1) second to no limit(annunciation until cleared by a local or CDS command).

6.14.7 Impact Sensor

An adjustable mechanical impact sensor shall be provided that can detect severe blows to the FVD and attempts at unauthorized or forced entry. The alarm unit shall activate the siren as soon as the impact sensor is triggered. All instances of alarm activation shall be recorded as events, shall be recorded locally at the FVD, and shall also be transmitted in an immediate manner to the CDS. In such cases, the siren shall shut off and re-arm after a separate WMATA-adjustable time period (default 60 seconds) unless continued impacts or attempts at intrusion are detected.

The impact sensor shall be initially set so that blows that are caused by a 1-pound object moving at 25 feet per second, applying perpendicular force in an area of 1 square inch anywhere on the FVD door shall cause the FVD siren to sound. Impacts of lesser force to the FVD enclosure shall not cause the siren to sound. WMATA shall be able to adjust this sensor for greater or lesser sensitivity.

6.14.8 Backup Power System

FVDs shall incorporate a backup power system, which shall be used to provide power to FVD machine systems in the event of an interruption of the main power source. The backup power system shall have the capacity to:

- Complete a Smart Media purchase transaction (only if payment for the Smart Media has been completed);
- Permit an orderly shutdown of FVD systems to occur;
- Provide power to the internal FVD Alarm Unit for at least a one hour period while the main power source is not available; and
- Permit transmission of all associated event data to the CDS, prior to the orderly shutdown of the FVD systems.

When the main power is unavailable for the FVD, the backup power system shall also power the internal service light for a period of not less than fifteen (15) minutes.

If the Contractor provides a rechargeable battery as the backup power source, the FVD shall contain the necessary equipment to maintain and re-charge the battery when necessary. Full information for the software and parameters for the backup power system shall be provided for review at the PDR and approval at the FDR. **CDRL 6-11**

6.15 Communication System

FVDs shall communicate with the CDS to successfully meet the requirements of the installation and FVD operation. This shall include, as a minimum, communication:

- Via integral standard Ethernet Interface with RJ45 connector(s); and
- Via wireless network interface built in, compliant with IEEE 802.11N Standard Protocols.

All communications between the CDS and FVDs shall be encrypted. The method of encryption to be employed shall be provided to WMATA for review at CDR and approval at FDR, and shall not contain any proprietary methods or tools for development, modification and/or operation. **CDRL 6-12**

When off-line, the FVD shall be able to vend Smart Media only until a WMATA-settable threshold value is reached for the vending of Smart Media as identified in Section 6.2.

In addition to the above communications, an FVD shall be capable of being configured to communicate via the Wireless Broadband System, as outlined in Section 15. This configurability shall be demonstrated during the First Article Testing.

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 FVD through the use of a compact flash RAM with a minimum capacity of 8GB.

6.16 Structure and Finish Requirements

6.16.1 Cabinet and Base

FVDs shall have an ergonomic external design that shall make the purpose of the FVD clear to Customers. The FVD shall be no larger than 80" high, 36" wide, and 25" deep. FVDs shall be securely constructed free standing and capable of mounting to a flat floor surface inside or outdoors. Structural framing shall be made of stainless steel, employing monocoque construction.

The FVD shall be constructed of Stainless Steel, Grade 304. All exposed surfaces shall be finished with a #4 Brushed finish. The minimum thickness of the door shall be 3 millimeters. The minimum thickness of all other surfaces shall be 2 millimeters.

The FVD shall have a detachable base assembly or pedestal that is constructed of Stainless Steel, Grade 316, and acts as an integral member of the assembly structure. The base assembly or pedestal shall contain no mechanical components related to or required for the operation of the FVD.

The base assembly or pedestal shall be securely anchored to the floor, possessing sufficient attachments to withstand static and shear loads experienced during machine operation and service. The base assembly shall have a lockable panel to permit access to wiring and mounting hardware within the base as well as any electrical connections.

All exterior surfaces shall be finished to permit easy removal of graffiti. Interior machine surfaces shall also be primed and painted, or plated with corrosion-resistant material, unless they are stainless steel. Regardless of what materials are used, the types of material shall provide full protection against exterior and/or interior rusting.

FVDs shall have a one-piece outer door located on the front of the machine for revenue servicing and maintenance access. All door hinges and locking mechanism shall be both secure and isolated from view. There shall be no edges along the door into which a tool or other device could be inserted for leverage to pry the door ajar. All interior and exterior edges shall be sufficiently contoured so as to ensure safety.

The FVD shall include an interior fold out shelf, able to support test equipment or a laptop computer, and tools.

There shall be a master power switch within the FVD. When this switch is moved to the “off” position, the FVD shall send an event message to the CDS and initiate an orderly shutdown.

All wires and cables associated with operation of the FVD shall exit from the bottom or the back of the cabinet to best suit the installation requirements. In both cases, the cables shall be secured against tampering or intrusion.

The FVD cabinet shall have adequate ventilation and drainage that shall prevent any accumulation of water, water vapor or any other substance within the FVD that would impede optimum operation of the equipment and any of the components. All ventilation openings shall be screened or filtered to prohibit insect infestation.

6.16.2 Lighting

6.16.2.1 Exterior Light

An exterior light/light system shall be provided, that serves to illuminate the front surface of the FVD to 25 foot-candles. The FVD shall be equipped with a lighting fixture to achieve the following:

A. Use LED or other low-power lighting sources;

B. Meet the vandal-resistant strength requirements given above for the cabinet. The material, thickness, and finish of the fixture enclosure shall be the same as those for the FVD housing.

C. Contain a commercially available lamp(s) and circuits, and be constructed to allow easy replacement of the lamp with access obtained by use of a key.

D. Provide an ambient light sensor to automatically turn on the light fixture when ambient light conditions on the reading surface of the FVD falls below 25 foot-candles. A bypass switch inside the enclosure shall permit the lighting fixture to be switched on and off manually.

6.16.2.2 Interior Light

The FVD shall have an internal light that shall provide sufficient illumination for service activities. This light shall be activated/ deactivated by opening/closing of the door. Should the power be unavailable for the FVD, the backup power system shall also power the internal service light for a period of not less than fifteen (15) minutes.

6.16.3 Locks and Security

Door locking systems shall utilize the locking system as identified in Section 2.

Each FVD door entry shall be recorded as an event at the FVD and transmitted in real time to the CDS. All other locks employed in the FVD shall be unique for this system and for the components they are controlling. These locks shall be similar throughout and keyed alike for all FVDs.

6.17 Recirculating Coins for Change Issuance (Option)

As an option for the FVD, the Coin Processing System shall recirculate coins by using inserted coins as a source of change **CDRL 6-13**:

6.17.1 Coin Recirculating System

The coin recirculating system shall be able to hold a minimum of 50 coins of each of the accepted U.S. coin types and WMATA adult tokens. Tokens shall be eliminated in the early portion of the NEPP implementation and WMATA shall be able to prohibit their acceptance as valid fare payment.. The coin system shall also be capable of accepting the addition of a fifth coin type to the recirculation system.

Deposited coins shall be directed to the coin recirculating system. If the recirculating module for a denomination has reached capacity, additional coins inserted shall be deposited in the coin vault.

In addition, through the setting of a parameter at the CDS, WMATA shall have the ability to easily route or re-route any particular denomination of coin directly to the coin vault rather than to the coin re-circulating system. The device shall be secure, and of sturdy construction, manufactured from stainless steel or another WMATA-approved material.

The FVD shall automatically detect the location of each coin unit, continuously monitor the contents of each, and adjust its operation accordingly. Coins shall be prevented from jamming in the system under all operating conditions. The FVD shall record the value and denominations of any coins transferred to and from the coin vault

Coin recirculating modules shall be serialized (both electronically encoded, and visually displayed from the outside), provide for the safe deposit and secure storage of coins. The FVD shall automatically detect the presence or absence of each coin module and the type of coins contained in each unit; the FVD shall automatically adjust its operation accordingly.

At no time shall a removed coin storage module provide unauthorized access to coins. Removal of a coin unit shall not expose coins or provide access to any unauthorized areas within the FVD, and shall immediately send an event to the CDS.

When dropped from a height of three (3) feet on a concrete floor on any corner or side, the full coin recirculating module shall retain its contents, shall not open, and shall not have its locking mechanism impaired.

6.17.2 Supplemental Coin Dispensing System

At least three supplemental coin hoppers shall be provided as part of the FVD coin processing system. These coin hoppers, which shall not be part of the coin re-circulating process, shall provide safe and secure storage of coins and not allow insertion or removal of coins and/or the hopper(s) without proper, keyed access, and software commands. Denomination of coins within a hopper shall be automatically detected when the hopper is installed in the FVD. This shall automatically cause the requisite logic changes for change making by the FVD.

If the Coin Processing System recirculates coins, the FVD shall contain a minimum of two supplemental coin hoppers.

Each supplemental coin hopper shall each have a capacity of at least 900 coins of any denomination (nickels, dimes, quarters, and dollar coins) chosen by WMATA. The coin hoppers shall be serialized (both electronically encoded, and visually displayed from the outside), shall be used as a supplemental stock of coins for automatic change making purposes, and shall operate as an integral component of the complete coin system.

The supplemental coin hoppers shall provide for the safe deposit and secure storage of coins. The hopper enclosure shall be secure, and of sturdy construction, and manufactured from stainless steel or another WMATA approved material.

When removed from the FVD, the coin hoppers shall be sealed such that no coins can be removed without proper keyed access to the hopper enclosure.

The FVD shall continue to function without a full complement of coin hoppers, and it shall not be necessary for all FVDs to be equipped with identical coin hopper configurations.

When dropped from a height of three (3) feet on a concrete floor on any corner or side, the full supplemental coin hopper shall retain its contents, shall not open, nor shall its locking mechanism be impaired. The supplemental coin hoppers shall have a handle or handles placed to avoid injury, which provides adequate gloved-hand clearance for easy insertion, removal and carrying. The maximum weight when full shall not exceed 40 pounds.

Removal of a coin hopper shall automatically:

- Generate, in electronic and paper form, revenue service audit reports identified in Section 6.4;
- Reset the associated coin hopper count within the FVD to zero;
- Transmit an event to the CDS.

Insertion of a new coin hopper shall automatically:

- Generate, in electronic and paper form, revenue service audit reports identified in Section 6.4;
- Set the associated coin hopper count within the FVD to a WMATA-defined count;
- Transmit an event to the CDS.

6.17.3 Change-Issuance Functionality

Change shall be issued to the Customer for those transactions where the cash value inserted exceeds the price of the purchased fare. If the cancel button is activated by the Customer before completion of the Smart Media sales transaction, or the transaction is otherwise aborted, the value of the deposited coins shall be returned to the Customer via the media/coin return tray.

Change and coins returned for cancelled transactions shall be provided in the fewest number of coins available within the system. When a given coin denomination is to be returned, the FVD change-making system shall first use coins that were deposited in an earlier transaction (i.e. “recirculated), unless doing so would result in returning more coins than necessary. The supplemental coin storage system shall be used as a source of change whenever doing so would result in fewer coins being returned as change or if the recirculating coin system is unable to dispense proper change.

The FVD shall keep track of the contents of each cash container in the coin processing system and shall be able to detect when each change-issuing container is near or completely empty, and when the coin vault is near or completely full. These situations shall cause events to be recorded by the Electronic Control Unit (ECU) and transmitted to the CDS. The determination of a nearly empty condition shall be software controllable and adjustable by WMATA.

Two capacity settings shall be provided for each coin container: a warning setting and a full (coin vault)/empty (other coin container) setting.

If the Coin Processing System recirculates coins, change payout shall utilize coins from the coin recirculation modules first, followed by any remainder dispensed in the fewest coins available.

6.17.4 Coin Commands

The FVD shall provide authorized revenue service personnel distinct commands to manually initiate the addition of coins to the coin recirculation system. When completed, a report shall be printed showing the number of coins in each unit; the number of coins added and the total value of coins added.

A command shall be provided via the service terminals to empty the recirculating coin unit to the coin vault. Supplemental coin hoppers shall not be affected by this command. This command shall be initiated through the service terminal and shall require an additional password to initiate. Initiation of this command shall cause an event message to be stored in the FVD memory, all revenue registers to be adjusted to reflect the contents of the coin vault and recirculating coin unit and the revenue report to reflect the change in the contents of the coin vault and recirculating coin unit.

6.17.5 Maximum Change

A series of programmable parameters within the application shall allow the FVD to limit the amount of change dispensed in the event that surplus cash is deposited for the selected fare. The FVD shall provide for a parameter which sets a maximum value of change which can be issued for each fare vended from the FVD. This shall be a WMATA-settable and configurable parameter with values between $0.00 and $19.95.

For each denomination of coin issued as change, a separately programmable maximum quantity to be dispensed for any single transaction shall be provided. These parameters shall be adjustable by WMATA at the CDS. If deposited cash would result in any of the maximum values to be exceeded, the FVD shall automatically notify the Customer, cancel the transaction and return deposited funds.

Note that these maximum parameters apply to coins only. If the FVD Coin Processing System recirculates coins, change payout may exceed the maximum coin change payout by the value of coins dispensed as change.

6.17.6 Exact Fare Mode

In the "Exact Fare Mode," the FVD shall have a maximum overpayment threshold. This parameter shall be adjustable by WMATA, both through the CDS and locally at each FVD. WMATA will provide the Contractor with the definition of the initial overpayment value parameter at the Final Design Review.

The FVD shall enter the "Exact Fare Mode" when the coin recirculating system and the supplemental coin storage system together contain insufficient coins to provide the maximum change payout (as limited by the per-denomination maximum payout parameters per section 6.7.8), or when the Coin Processing System contains less than 20 nickels.

If the Coin Processing System recirculates coins, $1 and $5 coins available for change shall be used to augment available coins when calculating the FVD's ability to issue the maximum change payout.

While in the "Exact Fare Mode," the Coin Processing System shall continue to accept inserted coins and coins, and shall continue to dispense change whenever possible as shown below.

6.18 Recirculating Coins for Change Issuance (Option)

As an option for the FVD, the Coin Processing System shall recirculate coins by using inserted coins as a source of change **CDRL 6-14**:

- The Coin Processing System shall be capable of recirculating at least four denominations of coins.
- The coin vault capacity shall be reduced from 2,000 coins to 1,00 coins.
- Coins in escrow shall be transferred as necessary to the corresponding coin recirculation module or to the coin vault.
- Upon cancellation of a transaction, all inserted coins shall be returned to the Customer.

- Upon completion of a transaction, all escrowed coins shall be retained in the corresponding recirculating module, or if that module is full, deposited into the coin vault.

- At the completion of a transaction, all inserted coins of denominations that are not recirculated shall be deposited into the coin vault.

- WMATA shall have the ability to configure the Coin Processing System (by individual FVDs and for all FVDs) to dispense recirculated coins as change either in the fewest notes possible, or in ways to minimize revenue service frequency. (For example, it shall be possible to configure the FVD to dispense up to ten $1 coins in lieu of higher denomination coins if the $1 coin escrow is more than half full.)

- Each coin recirculator module shall retain coins in a secure manner and with proper keyed access, shall be easily removed and exchanged for purposes of maintenance and jam clearance.

- Each coin recirculator module shall have a capacity of no less than 40 coins.

- Whenever it is removed from the FVD, a fully loaded coin recirculating module shall weigh no more than 20 pounds and be easily transportable.

- When dropped to a concrete floor on any corner or side from a height of not less than three (3) feet, the full coin recirculating module shall suffer no operational impediments and maintain security.

- Each coin recirculating module shall be able to be installed in a single orientation only. If a coin recirculating module is not properly installed, all coins assigned to that module shall be directed to the coin vault upon completion of a transaction. Security of the Coin Processing System shall not be impaired due to a missing recirculating module.

- The FVD shall support in-field exchange of coin recirculating modules. Upon insertion of a new coin recirculating module, the FVD shall set the coin count for that module to a WMATA-configurable default value.

- If the Coin Processing System recirculates coins, $1 and $5 coins available for change shall be used to augment available coins when calculating the FVD's ability to issue the maximum change payout.

- Each removal of a coin recirculating module shall automatically:
    - Generate, in electronic and paper form, revenue service audit reports identified in Section 6.4;
    - Reset the coin recirculator count within the FVD to zero;
    - Transmit an event to the CDS;
- Each insertion of a new coin recirculating module shall automatically:
    - Generate, in electronic and paper form, revenue service audit reports identified in Section 6.4;
    - Set the coin recirculator count within the FVD to the WMATA-set default;
    - Transmit an event to the CDS.

Transaction speeds shall not exceed the following maximums:

Table 6-3 – Maximum FVD Transaction Times

Sample Transaction Content	Maximum Time to Complete
One coin inserted Two coins returned	12 seconds
Two coins inserted One coin returned	12 seconds
One coin inserted Two coins returned Two coins returned	17 seconds
Five coins inserted Four coins returned	30 seconds

These speeds shall be based on:

- All inserted coins and coins are inserted at maximum possible speed; and
- All transactions are for the purchase of a single item of Smart Media.

6.19 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 6-1	Complete description of FVD functionality	6.1	CDR, PDR, FDR	Yes
CDRL 6-2	Complete description of each FVD type's physical characteristics	6.1.1	PDR	Yes
CDRL 6-3	All configuration and parameter settings	6.1.1	PDR, FDR	Yes
CDRL 6-4	Details for all transaction records	6.2	PDR, FDR	Yes
CDRL 6-5	Data dictionary	6.2	CDR, PDR, FDR	Yes
CDRL 6-6	Information to be printed on vouchers and receipts for cancelled transactions	6.2.2	PDR, FDR	Yes
CDRL 6-7	Displayed information and screen layouts for all transactions and messages	6.3.1	PDR, FDR	Yes
CDRL 6-8	Selection of voices for audio system	6.3.4	PDR, FDR	Yes
CDRL 6-9	Conceptual description of instructional graphics	6.3.5	PDR	Yes
CDRL 6-10	Format and content of each local FVD report	6.4	PDR, FDR	Yes
CDRL 6-11	Information for the software and parameters for the backup power system	6.14.8	PDR, FDR	Yes
CDRL 6-12	Encryption methodology for all the communications between the FVD and CDS	6.13	CDR, FDR	Yes
CDRL 6-13	Coin Recirculating System function and hardware	6.17	CDR, PDR, FDR	Yes
CDRL 6-14	Coin Recirculating System function and hardware	6.18	CDR, PDR, FDR	Yes

End of Section 6

Section 7 – Faregates
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7 FAREGATES

7.1 General

Faregate aisles, formed by a pair of faregates with matching barriers, shall be provided at Metrorail locations. The faregate barrier shall be a panel (bi-parting leaf, paddle, or other configuration) to permit high-speed throughput for both entering and exiting Customers. The following two types of faregate aisles shall be employed:

- A standard faregate aisle, with bi-parting leaves that is reversible in direction, with an aisle width matching the present standard aisle width; and.
- An “ADA” faregate aisle that is fully ADA compliant through which physically challenged Customers shall be able to pass, with bi-parting leaves and is reversible in direction.

The faregates shall operate with or without communication to the Central Data System (CDS). If the faregate on one side of a faregate aisle does not operate, then the faregate on the other side of the same aisle shall be inhibited from operating for that aisle, i.e., inhibited in both directions for that aisle.

Multiple faregates aligned in a row shall constitute a faregate array. Release of faregate barriers for passage through a faregate aisle shall always be controlled by a Payment Processing Target (PPT) located on the faregate to the right of the Customer passing through the faregate aisle.

An ADA faregate shall be furnished and installed within a faregate array at each station, as a minimum, 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.

Each faregate shall communicate with the CDS via the Station LAN (see Section 15).

The faregates shall function properly in all operating conditions found within the station environment as identified in Section 2.

A complete description of the faregates shall be provided for WMATA review and approval at each stage of the design review (CDR, PDR, FDR) with the final document fully describing the operation, capabilities, and functionality as described within this Section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 7-1**

The Contractor shall provide a complete description of each fareate type's physical characteristics including all materials, finishes, components, module details (manufacturer, model number, software/firmware version), dimensioned drawings, exploded drawings and other information to permit WMATA to understand which specific items of hardware are being used within each faregate type and their configuration. **CDRL 7-2**

All configuration and parameter settings shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 7-3**

7.2 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. As part of its configuration, each faregate shall be settable to accept or deny a reduced fare as a valid fare.

All text displayed by the faregate to Customers or maintenance/ servicing personnel shall be provided to WMATA for review at the PDR and for final approval at the FDR. **CDRL 7-4**

Faregates shall process all acceptable NEPP Smart Media as required in Section 3. Each time that the Smart Media is read by the faregate, a transaction record shall be stored by the faregate.

- When the Smart Media is presented to the PPT in the unpaid area data shall be forwarded to the CDS to ascertain validity of the Smart Media. Transaction data shall be stored within the faregate for that transaction; and

- When the Smart Media is presented to the PPT in the paid area data shall be forwarded to the CDS to ascertain the fee owed to complete processing of the Customer. Transaction data shall be stored within the faregate for that transaction.

All entry and exit transaction data shall be retained by the individual faregates until the data is completely and successfully transferred to the CDS for storage.

When the faregate is communicating with the CDS, the Invalid Smart Media List stored on the CDS shall be used. When CDS communications are not available or transactions cannot be completed within the time frames set in Section 3, the Invalid Smart Media List resident in the faregate or within the station shall be used. The Positive Number List shall also be used to verify the validity of Smart Media, as applicable.

The faregate logic shall permit up to a configurable number of fares (not less than five) to be banked in a single direction when Smart Media is used to traverse the faregate aisle. This shall be configurable by WMATA at the CDS. The total number of banked fares shall be displayed on the Customer display and decrement for each valid banked passage.

Each faregate aisle shall be capable of being set to any of the following operational modes:

- Active: Presents a physical barrier to impede Customer movement in both directions. Permits one entry/exit (valid Smart Media shall be verified), in either direction;
- Passive: Controls Customer flow through the use of sensors only. Does not present a physical barrier to impede Customer movement. Permits one entry/exit (valid Smart Media shall be verified), in either direction;
- Free Fare: Permits entry and/or exit, no fare or Smart Media required;
- Intermediate: Actively controls Customer flow in one direction, while allowing free fare in the opposite direction.

The start and stop times for each of the identified mode settings shall be settable via the CDS. Each faregate aisle shall be settable to any of the above settings as an array or independently without regard to the settings of other faregates in the array.

The setting 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, CDS control shall be provided to quickly set all faregates in an array to any of the operational modes.

A command shall be provided at the CDS 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.

The structure and layout of all transaction records shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 7-5**

7.3 Customer Interfaces

Customer interfaces shall be provided for Customer and station agents to understand faregate processing of Smart Media, the status of the transactions and to provide 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. **CDRL 7-6**

7.3.1 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.

7.3.2 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.

An indicator light shall also be provided as a visual signal that reduced fare Smart 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.

7.3.3 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 Smart Media status.

The Customer display shall be programmable to display various greetings and messages based on Smart 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 within the CDS to enable WMATA to change the messages without Contractor intervention.

Wording of messages to be displayed to the customers shall be defined at the Preliminary Design Review and finalized at the Final Design Review. **CDRL 7-7**

7.3.4 Audible Tones

Each Smart 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 Smart 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. **CDRL 7-8**

7.4 Fare Handling Hardware

The faregates shall incorporate modules to process the Smart Media identified in Section 3 to permit Customer passage through the faregates.

7.4.1 Payment Processing Target (PPT)

The faregate shall employ a PPT as identified in Section 3. 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 of approximately two (2) inches.

If the PPT fails, the Customer display on the faregate shall display "Out of Service" and the "Usage Prohibited" illuminated display at each end of the faregate aisle shall be lit until the PPT failure has been cleared.

7.4.2 Directional Sensors

Sufficient 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 and shall trigger generation and storage of an alarm message and transfer to the CDS.

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 the CDS. 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. **CDRL 7-9**

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. **CDRL 7-10**

7.5 Control System

Each turnstile 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.

Communication with the CDS shall be an integral element of the faregate. This communication shall occur via the NEPP Regional Rail Network outlined in Section 15. Communications between the faregates and the CDS, including both the uploading and downloading of transactions and operational data shall occur as necessary to support all NEPP requirements.

This shall include the transmission of 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 the NEPP System.

There shall be no dependency on maintaining communication with the CDS for normal operation. If communication with the CDS is interrupted, the faregate shall continue to operate in the normal manner but shall use local lists for Smart Media validation and shall immediately upload all transaction and associated data and information to the CDS upon restoration of communication.

The Smart Media to be accepted when there is a communications failure shall be settable by WMATA. Information describing this procedure shall be provided for WMATA review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 7-11**

Each faregate shall have an internally maintained calendar/clock. This shall synchronize with the CDS date/time for all time-related data each time it communicates with the CDS.

The faregate aisle and its faregates shall be able to be configured by the CDS 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 CDS and at the faregate. Local modifications to these settings shall be immediately communicated to the CDS.

Data shall be stored locally by the faregate and transferred to the CDS, for all activity performed, including, but not limited to, valid fares, invalid fares, alarms, events, changes in status and sensed conditions and data communication attempts (both successful and unsuccessful). Data stored at the faregate shall be stored in non-volatile memory.

7.5.1 Downloading

Downloading from the CDS to the faregate shall be used to:

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

In the event of loss of communication with the CDS, downloading of all stored data and uploading of all software and configuration information shall be possible on a local basis for an individual faregate with the use of a portable device.

Data communications methodology and information transferrable with the CDS shall be identified and provided to WMATA for review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 7-12**

7.5.2 Uploading

All data stored by the faregate as identified in Section 7.5.3 shall be transmitted to the CDS in a scheduled manner and upon request from the CDS.

7.5.3 Data Storage

All data shall be stored in the faregate memory until it has been transferred to the CDS. In the event communications cannot be established with the CDS for an extended period of time, data shall be retained locally, with storage for a minimum of 100,000 Customer transactions plus an equal number of event, audit and alarm transactions.

There shall be two distinct, physically separate non-volatile memory locations for the storage of data within the faregate. One location shall be an easily removable and replaceable standard device (redundant memory) and the other location shall be more permanent (main memory). The faregate shall store all data from its operation in both memory locations.

All data sent to the CDS shall originate from this memory and all data received from the CDS shall be stored in this memory. This memory shall be unaffected by faregate power status. The main memory shall be the primary data store and shall be used as the valid NEPP data. Should data integrity not be verified the data stored within the redundant memory shall be used as the valid NEPP data. Both data sets shall always be transferred to the CDS.

In the event data storage requirements are exceeded, the faregate shall take its adjacent aisle out of service until the data can be successfully transferred and the memory cleared for the transferred data.

Data (to provide a complete record of each transaction) to be stored and transferred to the CDS by the NEPP 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 completed transactions, which have occurred at the device ;
- All cancelled transactions, including reason for cancellation;
- All changes in status of the device or any module incorporated;
- All configuration changes;
- All successful communications;
- All communication failure;
- 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 revenues and Smart Media.

7.5.4 Passback Control

Each faregate shall monitor all Smart 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, on a bus or when used at other NEPP equipment. All Smart Media shall be verified against this passback list.

This time period, shall be settable and modifiable by WMATA via a downloaded parameter to a period from three (3) to sixty (60) minutes, in increments of one (1) minute. This parameter shall initially set to twenty (20) minutes, shall be settable by WMATA as a definable downloadable parameter from zero (0) minutes through sixty (60) minutes.

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

7.5.5 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.

7.5.6 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's memory for later transfer. 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 modifiable by WMATA at the CDS.

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

7.6 Communication System

Faregates shall communicate with the CDS to suit the needs of the installation and NEPP operation via a Station LAN as defined in Section 15.

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.

In cases of network failure, the faregate shall have capacity as identified in Section 7.5.3. Upon successful re-connection of network operations, all stored transaction data (e.g., alarm, event, sales) shall be automatically transmitted to the CDS.

7.7 Structure and Finish Requirements

7.7.1 Faregate Cabinet

The faregate shall be constructed of stainless steel, or other revenue service proven material as approved by WMATA, to meet the requirements of WMATA. 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.

All doors and access covers shall be locked with high security locks, keyed alike for all cabinets. The Contractor shall authorize WMATA to purchase additional locks and keys directly from the lock manufacturer.

Equipment cabinets, including the base, shall withstand a concentrated load of 300 pounds applied to any one area of one square inch or a uniformly distributed load over an entire surface of 50 pounds per square foot without causing damage or permanent deformation. 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.

Each faregate shall have incorporated within its housing a two-position power switch, which shall be used to power down and power up the faregate. In addition, a 120-volt duplex outlet shall be included within each faregate.

7.7.2 Faregate Barrier

The barrier mechanism shall accommodate high Customer volumes and shall not be tripod barriers. Barriers shall be panels (bi-parting leaves, doors, paddles, or other similar mechanisms) and 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.

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 power, or receipt of the appropriate signal from the fire control system, the faregate shall stop processing fares and barriers shall automatically open, permitting free 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.

7.8 ADA Faregate

The ADA faregate shall be identical to the standard faregate with the exception of the following:

- The faregate aisle shall have a minimum clear opening to meet ADA requirements.
- The PPT shall be installed on the front face of the faregate.
- 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 CDS. 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 CDS.

- The ADA faregate shall sense an open condition and shall transmit a message to the CDS 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 CDS 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.

Final design of the ADA faregate and barrier shall be approved by WMATA at the Preliminary Design Review. **CDRL 7-13**

7.9 Installation

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 not less than four 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 power and communications supplied from conduit within the floor. The use of ramps or any other configuration to conceal cabling on or above the floor is prohibited.

WMATA reserves the right to change the quantity of ADA faregates installed in any array at any station prior to WMATA approval of the installation drawings. 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. **CDRL 7-14**

7.10 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 7-1	Complete description of faregate functionality	7.1	CDR, PDR, FDR	Yes
CDRL 7-2	Complete description of each fareate type's physical characteristics	7.1	CDR, PDR	Yes
CDRL 7-3	All configuration and parameter settings	7.1	PDR, FDR	Yes
CDRL 7-4	Text displayed by the faregate	7.2	PDR, FDR	Yes
CDRL 7-5	Structure and layout of all transaction records	7.2	PDR, FDR	Yes
CDRL 7-6	Text and fixed graphics	7.3	PDR, FDR	Yes
CDRL 7-7	Wording of messages	7.3.3	PDR, FDR	Yes
CDRL 7-8	Proposed tones and volumes	7.3.4	PDR	Yes
CDRL 7-9	Alarm volume control	7.4.2	PDR	Yes
CDRL 7-10	Customer sensors	7.4.2	PDR, FDR	Yes
CDRL 7-11	Smart Media acceptance during communication failure	7.5	PDR, FDR	Yes
CDRL 7-12	Data communications methodology and downloaded information	7.5.1	PDR, FDR	Yes
CDRL 7-13	Design of the ADA faregate and barrier	7.8	PDR	Yes
CDRL 7-14	Installation drawings and prerequisites	7.9	PDR, FDR	Yes

End of Section 7

Section 8 – Turnstiles
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8 TURNSTILES

8.1 General

The NEPP System shall incorporate a standard, bi-directional turnstile, with a tripod barrier at gated stations. The turnstiles shall be required to be set to permit either entry or exit in order to operate. The turnstile shall not be operable simultaneously for both entry and exit. The turnstiles shall be designed to operate with the verification and validation of Smart Media to the passenger's right, whether entering or exiting the paid area and shall operate as both a stand-alone unit, and on-line connected to the Central Data System (CDS) to suit prevailing communications.

Multiple turnstiles aligned in a row shall constitute a turnstile array. Release of a turnstile barrier for passage through an aisle shall always be controlled by a Payment Processing Target (PPT) located on the console to the right of the turnstile aisle. Each turnstile shall be a stand alone device able to communicate independently with the CDS.

An ADA fare gate shall be furnished and installed within all turnstile arrays to permit Customers with disabilities and others who cannot use the standard turnstile 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 turnstile array, when required. It shall consist of a reversible gate and a mounting post, whose motion in either direction is controlled.

Each turnstile shall communicate with the other turnstiles and ADA Fare Gates within the array to share necessary information and with the CDS via the Station LAN (see Section 15).

Only Smart Media as identified in Section 3 shall be accepted for fare payment by the turnstiles.

The turnstiles shall function properly in all operating conditions found within the station environment as identified in Section 2.

A complete description of the functionality of the turnstiles shall be provided for WMATA review and approval at each stage of the design review (CDR, PDR, FDR) with the final document fully describing the operation, capabilities, and functionality as described within this Section 8. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 8-1**

The Contractor shall provide a complete description of the turnstile's physical characteristics including all materials, finishes, components, module details (manufacturer, model number, software/firmware version), dimensioned drawings, exploded drawings and other information to permit WMATA to understand which specific items of hardware are being used within the turnstile and their configuration. **CDRL 8-2**

All configuration and parameter settings shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 8-3**

8.2 Transaction Processing

The turnstiles shall be able to be configured for entry/exit control as well as freewheel operation. As part of its configuration, each turnstile shall be able to be set to accept or deny a reduced fare as a valid fare.

Turnstiles shall be able to process customers at a minimum rate of 35 customers per minute for valid passages through the aisle with fare validity verification and 45 customers per minute for valid passages through the aisle with no fare validity verification ("freewheel").

All text displayed by the turnstile to passengers or maintenance/ servicing personnel shall be provided to WMATA for review at the PDR and for final approval at the FDR. **CDRL 8-4**

Turnstiles shall process all acceptable NEPP Smart Media as required in Section 3. Each time that the Smart Media is read by the turnstile, a transaction record shall be stored by the turnstile.

- When the Smart Media is presented to the PPT in the unpaid area data shall be forwarded to the CDS to ascertain validity of the Smart Media. Transaction data shall be stored within the turnstile for that transaction; and

- When the Smart Media is presented to the PPT in the paid area data shall be forwarded to the CDS to ascertain thd fee owed to complete processing of the Customer. Transaction data shall be stored within the turnstile for that transaction.

All entry and exit transaction data shall be retained by the individual turnstiles until the data is completely and successfully transferred to the CDS for storage.

When the turnstile is communicating with the CDS, the Bad Number List stored on the CDS shall be used for Smart Media validity verification. When CDS communications are not available or transactions cannot be completed within the times identified in Section 3, the Invalid Smart Media List resident in the turnstile, or at the station, shall be used. The Positive Number List shall also be used to verify the validity of Smart Media, as applicable.

The turnstile logic shall permit a configurable number (not less than five) of fares to be banked in a single direction when Smart Media is used to traverse the aisle. This shall be configurable by WMATA at the CDS. The total number of banked fares shall be displayed on the Customer display and decrement for each banked valid banked passage.

Each turnstile shall be capable of being set to any of the following operational modes:

- Freewheel: Permit entry/exit without valid Smart Media;
- Normal: Valid Smart Media required for both entry and exit;
- Closed: Do not permit entry or exit;
- Free Entry/Lock Exit: Permit free entry to the paid area and deny exit. Typically, this is for emergency evacuation situations.
- Lock Entry/Free Exit: Permit free exit from the paid area and deny entry. Typically, this is for emergency exit conditions. This setting shall be automatically initiated when the power fails for a turnstile.

The start and stop times for each of the identified mode settings shall be settable via the CDS.

Each turnstile shall be settable to any of the first three settings without regard to the settings of other turnstiles in the array. When the fourth or fifth setting is applied, it shall apply to all turnstiles within the array.

The setting of each turnstile to one of the first three operational settings shall be capable of being set locally at the turnstile through a simple setting secured within the turnstile but accessible by authorized personnel. In addition, CDS control shall be provided to quickly set all turnstiles in an array to any of the operational modes.

A command shall be provided at the CDS that when initiated shall place all turnstiles in a mode to accommodate emergency egress from and prohibit access to the platform by Customers.

The structure and layout of all transaction records shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 8-5**

8.3 Customer Interfaces

Customer interfaces shall be provided for Customer and station agents to understand turnstile processing of Smart Media, the status of the transaction and to provide feedback. For this purpose, the following shall be incorporated into the turnstile:

- 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. **CDRL 8-6**

8.3.1 Fixed Graphics

Fixed graphics shall be provided on each turnstiles to clearly depict and guide customers to the locations of and correct use of the PPT.

8.3.2 Illuminated Displays

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

An indicator light shall also be provided as a visual signal that reduced fare Smart Media is being used for entry or exit. This indicator light shall be installed on each end of the turnstile, 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 turnstile array that reduced Smart Media has been used in a successful entry transaction. The indicator light shall remain lit until the turnstile returns to the idle mode or a subsequent fare is processed.

8.3.3 Customer Displays

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

The Customer display shall be programmable to display various greetings and messages based on Smart 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 within the CDS to enable WMATA to change the messages without Contractor intervention.

Wording of messages to be displayed to the customers shall be defined at the Preliminary Design Review and finalized at the Final Design Review. **CDRL 8-7**

8.3.4 Audible Tones

Each Smart Media transaction at the turnstile 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 turnstile;
- Smart Media not accepted, passage not permitted; or
- Reduced-fare Smart Media accepted, proceed through turnstile.

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. **CDRL 8-8**

8.4 Fare Handling Hardware

The turnstiles shall incorporate modules to process the Smart Media identified in Section 3 to permit Customer passage through the turnstiles.

8.4.1 Payment Processing Target

The turnstile shall employ a PPT as identified in Section 3. The PPT shall be integral to the turnstile and shall be housed within the turnstile cabinet in such a manner as to not inhibit its required read range of approximately two (2) inches.

If the PPT fails, the Customer display shall display “Out of Service” and the “Usage Prohibited” illuminated display at the end of the turnstile shall be lit until the PPT failure has been cleared.

8.5 Control System

Each turnstile shall include one or more microprocessors to control and monitor all functions of the turnstile. The failure of any microprocessor in any turnstile shall affect only one turnstile aisle.

Communication with the CDS shall be an integral element of the turnstile. This communication shall occur via the NEPP Network outlined in Section 15. Communications between the turnstiles and the CDS, including both the uploading and downloading of transactions and operational data shall occur as necessary to support all NEPP requirements.

This communication shall include the transmission of all entry data, exit data, turnstile status messages, configuration, control, and parameter information as well any additional information required by the Contractor's system to support successful operation of the NEPP System.

There shall be no dependency on maintaining communication with the CDS for normal operation. If communication with the CDS is interrupted, the turnstile shall continue to operate in the normal manner but shall use local lists for Smart Media validation and shall immediately upload all transaction and associated data and information to the CDS upon restoration of communication.

The Smart Media to be accepted when there is a communication failure shall be settable by WMATA. Information describing this procedure shall be provided for WMATA review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 8-9**

Each turnstile shall have an internally maintained calendar/clock. This shall synchronize with the CDS date/time for all time-related data each time it communicates with the CDS.

The turnstile shall be able to be configured by the CDS through the downloading of operational and configuration data. All functions available shall be selectable from a menu when setting up the operation of the turnstiles.

All configuration information sets shall be saved by the CDS and at the turnstile. Local modifications to these settings shall be immediately communicated to the CDS.

Data shall be stored locally by the turnstile and transferred to the CDS, for all activity performed, including, but not limited to, valid fares, invalid fares, alarms, events, changes in status and sensed conditions and data communication attempts (both successful and unsuccessful). Data stored at the turnstile shall be stored in non-volatile memory.

8.5.1 Downloading

Downloading from the CDS to the turnstile shall be used to:

- Synchronize the clocks;
- Execute commands;
- Provide updated software;
- Poll equipment for operational status;
- Download changes to system and equipment parameters;
- Provide lists and updates of lists identified in Section 2);
- Provide other data downloads to ensure proper operation of the turnstiles.

In the event of loss of communication with the CDS, downloading of all stored data and uploading of all software and configuration information shall be possible on a local basis for an individual turnstile with the use of a portable device.

Data communications methodology and information transferrable with the CDS shall be identified and provided to the WMATA for review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 8-10**

8.5.2 Uploading

All data stored by the turnstile as identified in Section 8.5.3 shall be transmitted to the CDS in a scheduled manner and upon request from the CDS.

8.5.3 Data Storage

All data shall be stored in the turnstile memory until it has been transferred to the CDS. In the event communications cannot be established with the CDS for an extended period of time, data shall be retained locally, with storage for a minimum of 100,000 Customer transactions plus an equal number of event, audit and alarm transactions.

There shall be two distinct, physically separate non-volatile memory locations for the storage of data within the device. One location shall be an easily removable and replaceable standard device (redundant memory) and the other location shall be more permanent (main memory). The turnstile shall store all data from its operation in a solid-state memory module.

All data sent to the CDS shall originate from this memory and all data received from the CDS shall be stored in this memory. This memory shall be unaffected by faregate power status. The main memory shall be the primary data store and shall be used as the valid NEPP data. Should data integrity not be verified the data stored within the redundant memory shall be used as the valid NEPP data. Both data sets shall always be transferred to the CDS.

In the event data storage requirements are exceeded, the turnstile shall take itself out of service until the data can be successfully transferred and the memory cleared.

All data sent to the CDS shall originate from this memory and all data received from the CDS shall be stored in this memory. This memory shall be unaffected by turnstile power status.

Data (to provide a complete record of the transaction) to be stored and transferred to the CDS by the NEPP 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 completed transactions;
- All cancelled transactions, including reason for cancellation;
- All changes in status of the device or any module incorporated;
- All configuration changes;
- All successful communications;
- All communication failure;
- 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 revenues and Smart Media.

8.5.4 Passback Control

Each turnstile shall monitor all Smart 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, on a bus or when used at other NEPP equipment. All Smart Media to the turnstile shall be verified against this list.

This time period, initially set to twenty (20) minutes, shall be settable by WMATA as a definable downloadable parameter from zero (0) minutes through sixty (60) minutes. The control of passback shall be based on all usages and attempted usages. When this parameter is set to zero, passback shall be deactivated and shall charge for each trip taken, regardless of the time between Smart Media taps. The passback timer shall be configurable by smart media product and can be zero if required.

Passback criteria and settings shall be separately selectable and assignable for each fare class/fare type combination.

8.5.5 Servicing Display and Keypad

An internal control mechanism, consisting of a display and keypad shall be incorporated installed into the turnstile in a user-friendly location to assist troubleshooting of the turnstile and for other 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.

8.5.6 Diagnostics

The turnstile shall be capable of detecting basic internal malfunctions. The malfunction detection shall cover at least failure of power circuitry, control circuitry, opening of an access panel, interface failure, and any failure of the PPT that could result in a false, incomplete, or corrupted encoding of Smart Media.

Internal diagnostic programs shall check the turnstile and its interfaces for proper performance each time it is turned on and after every maintainer login. When the performance of any parameter is not according to specification, the turnstile shall turn itself off and indicate this to the maintainer, both audibly and visually.

The detected malfunction shall be recorded in the turnstile's memory for later transfer. 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 turnstile. The information displayed shall indicate the type of failure that caused the turnstile to shut down.

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

8.6 Communications System

Turnstiles shall communicate with the CDS to suit the needs of the installation and NEPP operation via a Station LAN as defined in Section 15.

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 turnstile through the use of a compact flash RAM with a minimum capacity of 8GB. The compact flash RAM shall utilize a standard USB port.

In cases of network failure, the turnstile shall have capacity as identified in Section 8.5.3. Upon successful re-connection of network operations, all stored transaction data (e.g., alarm, event, sales) shall be automatically transmitted to the CDS.

8.7 Structure and Finish Requirements

8.7.1 Turnstile Cabinet

The turnstiles shall be constructed of stainless steel Grade 304L, except for the baseplate which shall be Stainless Steel of Grade 316L.

Upon loss of power, or receipt of the appropriate signal from the fire control system, the turnstile shall stop processing fares and shall default to a freewheel mode, permitting unpaid exit fro the paid area by Customers. Upon restoration of power, the turnstile shall return to its normal operating state without manual intervention within five minutes.

Turnstile 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 turnstile cabinets shall have identical exterior dimensions and identical appearance.

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

All doors and access covers shall be locked with high security locks, keyed alike for all cabinets. The Contractor shall authorize WMATA to purchase additional locks and keys directly from the lock manufacturer.

Equipment cabinets, including the base, shall withstand a concentrated load of 300 pounds applied to any one area of one square inch or a uniformly distributed load over an entire surface of 50 pounds per square foot without causing damage or permanent deformation. Plexiglas used to cover displays, photocells and pictograms, plus the displays themselves, shall be excluded from these requirements but shall be revenue service proven.

Turnstiles 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.

Each turnstile shall have incorporated within its housing a two-position power switch, which shall be used to power down and power up the turnstile. In addition, a 120-volt duplex outlet shall be included within each turnstile.

8.7.2 Turnstile Barrier

The barrier mechanism shall be a tripod arm, which shall minimize back cocking, and subsequent fare evasion. There shall not be any gaps greater than two inches between the turnstile barrier and the adjacent turnstile housing when the barrier is closed.

Closed tripod arms shall be able to sustain impacts in both directions of travel without permanent deformations or damage. The impact shall be equivalent to a 300 lb customer moving at 3 mph and striking the tripod arm at the end of the arm. A 300 lb downward force at the end of the tripod arm shall also cause no damage.

The force to rotate the tripod, at the maximum travel end of the tripod arm, shall not exceed 10 pounds.

8.8 Installation

Turnstiles 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 turnstile aisle.

The turnstile base shall be provided with not less than four mounting holes for securing the cabinet to the floor. Any specialized mounting devices shall be provided by the Contractor. The gap between the bottom of the turnstile and the flooring shall be filled to eliminate water ingress.

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

WMATA reserves the right to change the quantity of turnstiles installed in any array at any station prior to WMATA approval of the installation drawings. Installation drawings and prerequisites for the turnstiles shall be provided to WMATA for review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 8-11**

8.9 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 8-1	Complete description of turnstile functionality	8.1	CDR, PDR, FDR	Yes
CDRL 8-2	Complete description of the turnstile's physical characteristics	8.1	CDR, PDR	Yes
CDRL 8-3	All configuration and parameter settings	8.1	PDR, FDR	Yes
CDRL 8-5	Text displayed by the turnstile	8.2	PDR, FDR	Yes
CDRL 8-6	Structure and layout of all transaction records	8.2	PDR, FDR	Yes
CDRL 8-7	Text and fixed graphics	8.3	PDR, FDR	Yes
CDRL 8-8	Wording of messages	8.3.3	PDR, FDR	Yes
CDRL 8-9	Proposed tones and volumes	8.3.4	PDR	Yes
CDRL 8-10	Smart Media acceptance during communication failure	8.5	PDR, FDR	Yes
CDRL 8-11	Data communications methodology and downloaded information	8.5.1	PDR, FDR	Yes
CDRL 8-12	Installation drawings and prerequisites	8.8	PDR, FDR	Yes

End of Section 8

Section 9

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Section 10 – On-Board Bus Payment Target
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10 ON-BOARD BUS PAYMENT TARGET

10.1 General

Contractor shall provide and install an On-Board Bus Payment Target (OBPT), adjacent to the existing farebox location for all buses. The OBPT shall consist of two (2) cable-connected housings:

- The Operator Control and Display (OCD) for use by the operator to configure the OBPT and to monitor and, if necessary, intercede during the transaction. The OCD shall be utilized for all operator actions.
- The Passenger Transaction Unit (PTU) for use by the customer during a Smart Media transaction.

Various configurations of the OBPT shall be provided as follows:

- An OBPT which includes the OCD and PTU without interface to other on-board components (Configuration A);
- An OBPT which includes the PTU with GPS and wireless communication but uses an existing OCD installed on the vehicle (by Others) (Configuration B);
- An OBPT which includes the PTU with wireless communication but uses an existing OCD and GPS installed on the vehicle (by Others) (Configuration C); and
- An OBPT which includes the PTU but uses the existing GPS, OCD and wireless communication installed on the vehicle (by Others) (Configuration D).

The OBPT shall be able to process payments stored in the account linked to the WMATA media, as defined in Sections 3 and 4, without need for hardware or software modification.

When installed, the OBPT shall meet all ADA requirements. The OBPT shall also:

- Process Smart Media and receive Smart Media validity authorizations from the Central Data System (CDS), via wireless communication;
- Interface and interoperate with on-board components provided by Others, as required to meet operational requirements;

- For vehicles equipped with a GPS provided by Others, receive and log the GPS location into each transaction record;
- For vehicles equipped with an OCD provided by Others, log-on to, monitor, and control the OBPT via that OCD;
- Respond to operator's actions and selections;
- Display the Smart Media validity information to the Customer and operator during processing;
- Display instructions and notices;
- For vehicles equipped with an OCD provided by Others, receive a message that identifies when the vehicle's engine is not running and operate in a reduced power mode when the vehicle's engine is not running;
- Generate and store transaction data;
- Provide different audible annunciations for valid and invalid transactions;
- Incorporate diagnostics to sense and identify problems with the OBPT;
- Communicate with the CDS for verification of authenticity and validity for all Customer transactions via wireless communications;
- Communicate over the existing Vehicle Area Network (VAN) using J1708/J1587 standard messages.
- Communicate with the CDS to receive commands, transmit, and receive data regarding sales, revenue, accounting, status, and security information (via the wireless data transfer system and via the memory module).

The OBPT shall be modularly upgradeable so that it does not need to be replaced in its entirety to increase memory capacity, to replace the OCD, to upgrade processing performance, or to maintain compatibility with ISO/IEC-14443 standards as they evolve. When installed, the OBPT shall meet all ADA requirements as identified in Section 2.

A complete description of the functionality of the OBPT shall be provided for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality as required within this Section. Methods for modifying an WMATA modifiable items shall be included. Sufficient detail shall be provided to permit verification that all requirements are satisfactorily included. **CDRL 10-1**

The Contractor shall provide separate dimensioned drawings of the OBPT showing all displays and openings/interfaces with doors/covers both open and closed for review at the Conceptual Design Review and for approval at the Preliminary Design Review. **CDRL 10-2**

The OBPT messages displayed, their triggers and their wording, shall be submitted for WMATA review at the Preliminary Design Review and finalized at the Final Design Review. **CDRL 10-3**

10.2 Operator Control and Display

The OBPT shall be operated using the OCD. The OCD shall have two configurations:

- The data terminal integral to the CAD/AVL system (provided by Others); and
- One that is a component of the OBPT (supplied by the Contractor). The Contractor-supplied OCD shall be capable of displaying all information shown on the PTU Customer display and shall include a touch-sensitive screen or a keypad with a minimum of 12 separate soft keys.

All interaction by the operator with the OBPT shall be through the OCD only. In all configurations, the OCD shall be used to command and operate the OBPT, including, but not limited to:

- Logon;
- Logoff; and
- Selection of the fareset.

The OCD shall at all times synchronized with the PTU, so all data and information displayed on the PTU shall be simultaneously displayed on the OCD.

In addition, every Customer transaction shall result in information to be displayed to the vehicle operator via the OCD.

The OCD shall include an audio transducer that shall simultaneously emit the same tones and patterns of tones as the PTU as described in Section 10.6.3.

The Contractor-supplied OCD shall include status LEDs as described in Section 10.6.2.

The OCD display shall be easily read under all conditions of ambient light throughout the day and night.

For Configurations B, C, and D, the OCD integral to the OBPT shall be included and shall be used as a secondary logon method. Whenever the vehicle operator successfully logs on using the secondary logon method, all data from other on-board components shall be ignored until another vehicle operator logs on.

Successful logon using the secondary logon method shall be achieved when all information is properly entered into and accepted by the OCD within a WMATA-defined and configurable time period.

10.3 Passenger Transaction Unit

The Passenger Transaction Unit (PTU) shall employ a user interface whose functions are straightforward and consist of no less than the following:

- A Payment Processing Target (PPT) capable of processing Smart Media types that are employed by the NEPP System to permit proper interoperation with all other NEPP devices;
- A backlit full-color Customer graphical display readable in direct sunlight, capable of displaying no less than 64 characters of ADA-compliant text, and characters and symbols up to 1 inch in height;
- A simple “green / yellow / red” LED array (or alternatively, similar use of the color Customer graphical display) to indicate the result of the transaction and status of the OBPT; and
- An audio transducer capable of generating the specified tones and patterns of tones as described in Section 10.6.2.

The PTU Customer display shall be easily read under all conditions of ambient light throughout the day and night. Results of all transactions and display of all messages for the Customer shall be provided on this display.

10.4 Operator Access

Logging on and logging off the OBPT shall be conducted through the OCD based on the OBPT configuration identified in Section 10.1. For Configurations B, C and D, when the CAD/AVL is activated, but before logon to the CAD/AVL has been performed, the CAD/AVL shall initiate communication with the OBP to permit Smart Media to be used as a part of the logon process.

10.4.1 Logon

Logging on shall include configurable logon parameters as outlined in 10.4.3. The log-on data shall be verified against a list of corresponding parameter values. This information shall be controlled via authorized users, stored within the CDS, and transmitted to the OBPT. If an invalid item of data is identified as being entered, then the OBPT logic shall identify the invalidities and request re-entry of the data. These invalidities shall be stored as transaction records and transferred to the CDS for reporting.

The OBPT shall not enter revenue service without a properly installed redundant memory module.

10.4.2 Logoff

Upon logoff, all displays shall be extinguished and the OBPT shall enter its low-power idle state. Logoff shall also occur automatically as part of the data transfer to the CDS. Automatic log-off of the OBPT shall also be provided after a WMATA-settable amount of time has elapsed since the last transaction. This feature shall be enabled by a WMATA-adjustable parameter. Upon any method of logoff, a transaction record shall be stored to indicate that an automatic logoff has occurred; the type of logoff shall also be recorded`.

10.4.3 Logon Configurability

Logon to the OBP shall provide for numerous prompts displayed and data to be entered to achieve a successful logon. No less than ten configurable logon parameters shall be supported for logon. Each logon sequence and entry selection shall be configurable for each Transit Agency. These entries shall be selected from entries stored at the CDS, including, but not limited to the following entries:

- Operator ID;
- Operator PIN;
- Route number;
- Run number;
- Block number;
- Direction;
- Trip number;
- Work assignment;
- Zone
- Service.

Data of not less than 10 digits shall be able to be entered for each logon entry, as selected by the Transit Agency.

10.5 Transaction Processing

Upon completion of each transaction, the OBPT shall:

- Display the results of the transaction on the PTU Customer display and OCD;
- Cause both the PTU and the OCD to emit the same distinct tone or pattern of tones, based on transaction validity; and
- Illuminate the proper LED (or display the proper color on the Customer display).

If a Smart Media read failure occurs for three out of five consecutive processing attempts, or the OBPT fails in any other manner such as to inhibit its operation, the device shall revert to its "Out of Service" mode and not accept any Smart Media for processing. This shall cause the visual indicator to become red, an event message to be stored and an “Out of Service” message to be displayed on the Customer Display and the OCD.

Displayed Customer messages shall be easily modifiable by WMATA, without Contractor assistance once the system is in operation.

The OBPT shall process Smart Media as appropriate to the type of validity information stored and as identified in Section 3.

10.6 Fare Handling Hardware

10.6.1 Payment Processing Target

The OBPT shall have an integrated commercially available ISO/IEC-14443 compliant Type A and B contactless Payment Processing Target (PPT) as identified in Section 3.

10.6.2 Transaction Status LEDs

The Contractor-supplied OCD and the PTU shall include three LEDs – one each in green, yellow, and red – to indicate the status of the last Smart Media transaction as well as the status of the OBPT after the returning to the idle state:

- Green to indicate a valid transaction has been processed;
- Yellow to indicate a problem with processing the Smart Media; and
- Red to indicate an invalid transaction has been processed.

The LEDs shall be located on the face of both OBPT modules and shall be positioned so that they are easily visible in all ambient lighting conditions by a Customer using the PTU and the operator using the OCD.

Alternatively, in lieu of separate LEDs, the color displays of the PTU and OCD may be used to convey the transaction status.

10.6.3 Audible Tones

An audible tone shall be provided for the acceptance and processing of valid Smart Media. A second audible tone shall be provided for an unsuccessful transaction or upon the presentation of invalid media. These audible tones shall be settable in the field by maintenance technicians as well as at the CDS.

Both the Contractor-supplied OCD and the PTU shall be capable of emitting at least eight (8) distinct sounds or sound patterns. Tones shall be associated with transaction outcome, as follows:

- Positive tone or tones: Transaction successful, associated with solid green LED
- Advisory tones: Advisory alert, associated with solid yellow LED
- Negative tone or tones: Transaction is unsuccessful, associated with solid red LED

The tones utilized for the OBPT shall be the same or similar to those utilized for the Platform Validator.

All sounds emitted by the OBPT shall be directed and of sufficient volume to be heard by the Customer and the bus Operator in a public transit vehicle environment. Tone volume shall be capable of being set individually in the field and via parameter downloaded from the CDS.

The sounds and sound patterns shall be demonstrated for WMATA review and approval at the Preliminary Design Review. **CDRL 10-4**

10.6.4 Global Positioning System

The OBPT shall incorporate integrated hardware and software for a Global Positioning System (GPS), including the appropriate antenna where required. The GPS shall provide latitude and longitude information and shall append this information to every transaction record. For the GPS System:

- Software shall be required for the CDS to configure, control and otherwise operate the GPS system, including setting up stops;
- GPS hardware and software shall meet the same operational and performance requirements as the OBPT, including design

review and submittal requirements;

- OBPT performance shall not be degraded by integrating the GPS system into the OBPT; and
- The OBPT shall update its GPS location information at a WMATA-configurable interval, initially set to every 15 seconds.

If the OBPT is deployed within a Transit Agency's system which incorporates GPS provided by another system installed on the vehicle, the OBPT shall accept the GPS information from that source at intervals and/or event occurrences defined by that source. That GPS information may include other elements beyond lat/long, such as Bus Stop ID. Final requirements to be discussed and agreed during design reviews.

10.6.5 Electronic Control Unit

The OBPT shall be controlled by an integrated Electronic Control Unit (ECU). The ECU shall be modular and shall control all aspects of the OBPT, including communication via a secure network with the CDS. All authorization request responses, fare tables, operational parameters, settings, lists and other such information shall be received from the CDS. All authentication requests, transaction records and data shall be sent to the CDS.

The OBPT shall store all data from its operation in a solid-state memory module as defined in Section 10.6.5.1. All data sent from the CDS shall originate from this memory and all data received from the CDS shall be stored in this memory. This memory shall be unaffected by OBPT power status.

The CDS shall be capable of downloading updated application software to the OBPT. Each of these downloads shall include a date and time of activation. Upon activation of the new application software, the OBPT shall automatically reset and begin operation with the new application software. Data transfer between the OBPT and the CDS shall be as identified in Section 10.7.

10.6.5.1 Data Storage

All data shall be stored in the OBPT main memory and shall not be overwritten or modified until all data is successfully transferred to the CDS. The main memory shall have sufficient capacity to locally store the Operational Smart Media Lists (see Section 2), a minimum of 100,000 transaction records, 2,000 summary records (including time segment records) and 2,000 event/alarm records before a memory full condition is reached.

The main memory shall be backed-up with a physically separate, removable, redundant memory module. The redundant memory module shall be a compact flash RAM with a capacity to accommodate all data stored in the main memory or a minimum of 8GB, whichever is greater. When the data storage capacity is exceeded in either the redundant or main memory, the OBPT shall take itself out of service until the data can be successfully transferred and its memory cleared.

10.6.5.2 Timeouts

The OBPT shall provide WMATA-adjustable time-out periods to return the OBPT to the idle state between transactions.

This timer shall limit the amount of time the OBPT waits after completion or cancellation of a transaction before resuming the idle state. The inter-transaction time-out shall be initially set to two (2) seconds but shall be adjustable by WMATA from 0 to 15 seconds in increments of 0.1 seconds.

10.6.5.3 Operational Smart Media Lists

When the OBPT is communicating with the CDS, the Bad Number List stored on the CDS shall be used. When CDS communications are not available or transactions cannot be completed within the times identified in Section 3, the Invalid Smart Media List resident in the OBPT shall be used. The Positive Number List shall also be used to verify the validity of Smart Media, as applicable.

10.6.5.4 Passback Control

Each OBPT shall monitor all Smart Media usages to prevent use of any unlimited ride product for more than one concurrent trip within a defined time period. All Smart Media presented to the OBPT shall be verified against this list.

This time period, shall be settable and modifiable by WMATA via a downloaded parameter to a period from three (3) to sixty (60) minutes, in increments of one (1) minute. This parameter shall initially set to twenty (20) minutes. The control of passback shall be based on uses of Smart Media at an OBPT for the present trip. The passback timer shall be configurable by smart media product and can be zero if required.

Passback criteria and settings shall be separately selectable and assignable for each fare class/fare type combination.

10.6.5.5 Transaction Records

Transaction data to be stored and transferred to the CDS by the OBPT shall include, as a minimum:

- All completed and transactions, including all data needed to provide a complete record of the transaction;
- All invalid transactions, including reason for invalidity;

The OBPT shall store transaction records for each transaction performed at the OBPT.

Each transaction record shall include the date, time, vehicle number, operator ID, and all pertinent data for the transaction. Additionally, transaction records shall include the location information as provided by the OBPT GPS system, as defined in Section 10.6.4.

Summaries shall be kept of revenue and transaction data in the OBPT.

Each transaction and summary record shall be recorded at the OBPT and transmitted to the CDS immediately upon communication between the two. Each record shall be uniquely identified within the NEPP System.

The OBPT shall have sufficient capacity to store, at a minimum, ten days' event and transaction data for use for cases of network failure or failure of the wireless communications. This data shall be stored in both the OBPT main memory and in redundant memory.

To protect against missed and duplicate data, each record transferred to or from the OBPT shall be serialized. Each time the OBPT data is successfully transferred the last transaction number shall be transferred to the CDS, and the serialized transaction number shall be automatically reset.

Each transaction record shall be unique within the NEPP system and shall include the following information as a minimum:

- Operator ID;
- Smart Media serial number;
- Date and time of transaction;
- Vehicle number;
- OBPT number;
- Run number;
- Route number;
- Direction;
- Vehicle location (GPS latitude and longitude);
- Fare Table number;
- Fare Type;
- Fare Class;
- Number of Customers;
- Method of payment;
- Transaction number;
- Stop number information (if available).

The structure and layout of all transaction and summary records, as well as all data required for each type of transaction shall be identified by WMATA at the Preliminary and Final Design Reviews with the final document fully describing each transaction record. **CDRL 10-5**

10.6.5.6 Event Records

The OBPT shall generate an event record for each alarm, event and operator action that occurs at the OBPT, including each of the following actions or incidents as a minimum:

- All events and alarms sensed;
- All events and alarms cleared, including the identification of the user which cleared the alarm;
- All status changes of the device or any module incorporated;
- All software and firmware version changes;
- All configuration changes;
- 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 revenues and Smart Media;
- Failures and performance incidents, for use by maintenance personnel;
- Operator log-on incidents with operator number and other log-on information;
- Operator log off, and method of log-off;
- End of transit business day (WMATA programmable time, default is 3:00 am);
- Data transfer starts;
- Data transfer ends;
- The internal clock fails;
- The internal clock is reset;
- The OBPT memory is about to overflow (WMATA programmable memory percentage);
- Changing from one fare table to another;

- OBPT powers off;
- OBPT powers on;
- Successful data transfer of transactional data;
- Unsuccessful data transfer of transactional data;
- Successful download of configuration data;
- Unsuccessful download of configuration data;
- Security alarms, errors and intrusions – This information shall be stored in a separate security file at the CDS, access to which shall be protected by security password; and
- Results of automatic diagnostics.

10.6.5.7 Diagnostics

The OBPT shall be capable of detecting basic internal malfunctions. The malfunction detection shall cover at least failure of power circuitry, control circuitry, opening of an access panel, interface failure, and any failure of the PPT that could result in a false, incomplete, or corrupted encoding of Smart Media.

Internal diagnostic programs shall check the OBPT and its interfaces for proper performance each time it is turned on and after every operator login and log-off. When the performance of any parameter is not according to specification, the OBPT shall automatically go out of service and indicate this to the vehicle operator, both audibly and visually. The detected deficiency shall be recorded in the OBPT's memory for later transfer. 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.

Upon power-up, the OBPT shall conduct a Power On Self Test (POST) that exercises all displays, LEDs, and audio transducers to permit the operator to confirm that all indicators are functioning.

Out-of-service conditions shall be annunciated on the OCD. The information displayed shall indicate the type of failure that caused the OBPT to shut down. Method for changing this text and for setting priorities shall be provided

10.7 Communications

The OBPT shall communicate wirelessly to the CDS to verify fare media is authentic and authorized for the desired trip and for all data transfer activities. The OBPT shall include all hardware and software necessary for wireless data communication with the CDS, based on the configuration required for proper operation for the WMATA/Regional Transit Agency.

WMATA (using Configuration D) is in the process of procuring a new Vehicle Area Network (VAN) with appropriate devices, protocols and software for wireless communications, CAD, AVL and other functionality. Communication by the OBPT with the CDS shall be via this VAN communication system. Primary data communication shall use the communication system for the COABE System being procured and be based on:

- Open protocols which shall include IEEE 802.3 Ethernet with TCP/IP for LAN communications;
- IEEE 802.11 a/g/n wireless LAN;
- IEE802.11i for data security and integrity;
- The use of IP for wide area network communications, and the use of TCIP 3.0, SAE and EIA protocols for VAN communications or as otherwise approved by WMATA. Messaging between the OBPT and the new VAN shall be provided using the SAE J-1587 messaging standards.

Primary communication for Regional Partner vehicles shall be using the method identified in Section 15.1.4.

Wireless data communications shall be accomplished at the Bus Facilities/Garages using the equipment installed at those locations. This equipment shall include access points and all other hardware and software elements to ensure that the data communications requirements throughout these technical specifications can be achieved and can interface into the Communications system specified in Section 15.

At the end of a run, when the OBPT arrives in range of the wireless communications system, the OBPT shall communicate with the CDS and shall transmit OBPT health/status information as well as all data stored by the OBPT. Updates to parameters shall also be downloaded to the OBPT at these times.

When the OBPT is on the road and out of range of the garage, but the wireless communication system is operating as identified in Section 15, the OBPT shall communicate with the CDS and shall transmit all status data, including OBPT information immediately upon change in any status, including memory capacity.

Upon successful re-connection of network operations, all stored transaction data (e.g., alarm, event, sales) shall be automatically transmitted to the CDS. Access to the data stored by the main memory and redundant memory shall be retrievable using a portable programming device.

The OBPT shall also have the capability to permit configuration modifications through the CDS and through the use of a portable programming device. The portable programming device shall not collect and store transaction data, but shall be used for downloading parameters and other operational information to the OBPT. All configuration changes shall be tracked and the records of these changes shall be stored in the OBPT memory and transferred with the transactional data to the CDS. These records shall include the portable programming device number used for data download.

The details of the configuration changes, communication interface and data transfer shall be subject to WMATA review and approval at the Final Design Review. **CDRL 10-6**

10.8 Structure and Finish

The OBPTs shall be compact, ergonomically designed, simple to use, and sufficiently robust to deter and withstand acts of vandalism and Customer abuse common to such on-board operations.

The PTU, as installed on-board a vehicle, shall fit within an envelope of twelve inches high by 4 inches deep by seven inches wide.

The OCD used to operate the PTU in Configuration A or as a secondary logon device for Configurations B, C and D, as installed on-board a vehicle, shall fit within an envelope of six inches high by two inches deep by four inches wide.

The PTU, as installed on-board a vehicle, shall fit within an envelope of twelve inches high by 4 inches deep by seven inches wide.

The PTU enclosure shall be constructed of stainless steel or other suitably vandal-resistant materials.

The Contractor shall supply all mounting hardware as required. Maintenance access to the OBPT internal components shall be via one or more panels that are secured with electronic high-security locks and locking mechanisms.

All OBPT access panels and doors shall be on the front or top face of the OBPT, shall be locked and opened with a key. The OBPT shall detect the position and status of all access panels and shall go out of service and record an appropriate event whenever any access panel/door is opened. All security provisions, including lock(s) and access panel/door latching schemes for OBPT shall be submitted for WMATA review and approval at the Preliminary Design Review. **CDRL 10-7**

10.9 Installation

The PTU shall be installed adjacent to the farebox in close proximity to the front door, and be positioned so that an entering Customer may easily present their Smart Media. The mounting position of the OCD shall permit the operator to comfortably reach and manipulate all of the OCD controls and observe the OCD display.

WMATA will perform a review of each vehicle type within their fleet and identify power, signaling and communications demarcations within each vehicle type. Contractor shall provide all cabling from those identified demarcation points to the OBPT to ensure proper operation as defined. These demarcation points are as identified in Exhibit XX.

The OCD position shall allow the operator to quickly inspect the display without undue head movement and operate the buttons without fully extending their arm. The OBPT shall be capable of being mounted on the handrail and on a post/pedestal, to accommodate installation on the various types of vehicles. Installation shall not impede the progress of the Customer.

The OBPT positioning shall allow for probing and cashbox removal of the existing farebox and the rapid removal of the OBPT equipment from the vehicle. In addition, the OBPT shall be installed to permit complete and unrestricted opening of OBPT and farebox maintenance/access panels/doors. Contractor shall be responsible for the design of the installation of the OBPT for each WMATA vehicle type.

All wiring terminations and harness interconnections shall be of sealed design, subject to the approval of WMATA at Final Design Review. **CDRL 10-8**

All costs incurred for removal or repositioning of the devices or handrails on any vehicle shall be the responsibility of the Contractor.

The location and mounting positions and methods of the OBPT and OCD on each vehicle type in the WMATA system shall be submitted for WMATA review at the Preliminary Design Review, and for approval at the Final Design Review. **CDRL 10-9**

10.10 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 10-1	Complete description of OBPT functionality	10.1	CDR, PDR, FDR	Yes
CDRL 10-2	Dimensioned drawings	10.1	CDR, FDR	Yes
CDRL 10-3	Messages displayed, triggers and wording	10.1	PDR, FDR	Yes
CDRL 10-4	Sounds and sound patterns	10.6.3	PDR	Yes
CDRL 10-5	Data Dictionary	10.6.5.5	PDR, FDR	Yes
CDRL 10-6	Details of the configuration changes, communication interface and data transfer	10.7	FDR	Yes
CDRL 10-7	Details of all security provisions and latching schemes	10.8	PDR	Yes
CDRL 10-8	Design of wiring terminations and harness interconnections	10.9	FDR	Yes
CDRL 10-9	Location and mounting positions and methods of the OBPT	10.9	PDR, FDR	Yes

End of Section 10

Section 11 – Platform Validators
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11 PLATFORM VALIDATORS

11.1 General

Platform Validators (PVs) shall be deployed at selected locations as required by WMATA, to process Customer Smart Media at commuter rail stations, street car locations and other WMATA and Regional Partner-defined locations such as bus shelters and stops.

PVs shall be compact, ergonomically designed, simple to use, and sufficiently robust to withstand the operational environment encountered in unsheltered locations and to deter acts of vandalism. Platform Validators shall

- Be able to be programmed such that they know the station and fare zone in which they are located;
- Be able to provide Smart Media validity information to the Customer.

The PVs shall support three modes of operation; selection of operating mode shall be configurable at time of installation:

- Operate as part of a tag-on/tag-off system (Operational Method 1);
- Operate as part of a flat-fare system where Customers must only tag-on prior to boarding (Operational Method 2); and
- Permit the Customer to select a destination zone or location using one of the Customer Selection Buttons on the PV prior to processing the Smart Media (Operational Method 3).

The PV shall be modularly upgradeable so that it does not need to be replaced in its entirety to increase memory capacity, to upgrade processing performance, to provide for additional Smart Media functionality or to maintain compatibility with ISO/IEC-14443 standards as they develop.

The Contractor shall provide a complete description of the functionality of the PVs for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality as described within this Section. Sufficient detail shall be provided to permit verification that all requirements are satisfactorily included. **CDRL 11-1**

The Contractor shall provide a complete description of the PV physical characteristics including all materials, finishes, components, module details (manufacturer, model number, software/firmware version), dimensioned drawings, exploded drawings and other information to permit WMATA to understand which specific items of hardware are being used within the PV and their configuration. **CDRL 11-2**

All configuration and parameter settings shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 11-3**

11.2 Transaction Processing

The PV shall incorporate as part of its configuration data the location (zone, station, etc.) of installation.

When the Smart Media is tagged at the PV, the location, date, time and other required information shall be used for the calculation of the fare. Upon completion of each transaction, the PV shall:

- Display the results of the transaction on the Customer display;
- Provide an audible translation of the results (if the “Audio” selection is activated by the Customer);
- Emit a distinct tone which identifies transaction validity; and
- Illuminate the proper LED.

The PV shall also be able to electronically read an item of Smart Media and provide the current status and validity of the Customer’s linked Transit Account.

If a Smart Media read and/or write failure occurs for three out of five consecutive processing attempts or the unit fails in any other manner such as to inhibit its operation, the device shall revert to its "Out of Service" mode and not accept any Smart Media for processing. This shall cause the visual indicator to become red and an “Out of Service” message to be displayed on the PV.

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

- All events and alarms sensed;

- All events and alarms cleared, including the identification of the user who cleared the alarm;
- All completed transactions, with data to provide a complete record of the transaction;
- 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 revenues and Smart Media.

11.3 User Interface

The PV shall employ a user interface that is flexible, easy to understand by the Customer and configurable by WMATA without the intervention of the Contractor or one of its representatives. The interface shall consist of no less than the following:

- A Payment Processing Target (PPT) capable of processing Smart Media types that are employed by the NEPP System to permit proper interoperation with all other NEPP devices.
- A backlit Customer graphical display, suitable for installation in unsheltered outdoor environments and readable in direct sunlight;
- A simple green / yellow / red LED array to indicate the result of the transaction;
- A voice message system; and
- An audio transducer capable of generating the specified tones and patterns of tones as described in Section 11.3.5.

Upon completion of each transaction, the PV shall identify the validity of the transaction on the Customer display, emit a distinct tone, and illuminate the proper red, yellow, or green LED, based on the results of the transaction.

Upon Customer removal of the Smart Media from the “read” field of the PV, the unit shall revert to the "Ready" mode, enabled for processing the next item of Smart Media within the time period identified in Section 11.4.2.

Designs of the PV fixed instructions and related graphics shall be submitted for WMATA review and approval as part of the Preliminary Design Review. **CDRL 11-4**

11.3.1 Payment Processing Target

The PV shall have an integrated commercially available ISO/IEC-14443 compliant Type A and B contactless Payment Processing Target (PPT) as identified in Section 3.

The PPT antenna shall be located on the PV such that Customers have easy access to tag their Smart Media. The external antenna shall not protrude from the exterior of the PV enclosure, and shall be made of materials that are impervious to weather conditions and resist overt vandalism.

11.3.2 Customer Display

The PV shall include a graphic display to provide Customers with the results of their transaction. The display shall be readily visible under all conditions of ambient light throughout the day and night and shall be protected against vandalism and outdoor operating conditions.

This graphic display shall be capable of displaying no less than 64 characters of ADA-compliant text, and characters and symbols up to 1 inch in height. Results of all transactions for the Customer shall be provided on this display.

The display shall also incorporate a “screen saver” function in a standard movie format. This screen saver shall be able to be replaced and deactivated by WMATA without assistance from the Contractor or its representative.

Settings for the screen saver shall also be able to be modified by WMATA, and such settings shall include the time required for activation of the screen saver based on time of inactivity at the PV. All timings and configuration and parameter settings shall be identified and described. Method for changing settings shall be provided.

Screens shall be easily modifiable by WMATA once the system is in operation. Method for modifying screens shall be provided.

11.3.3 Customer Selection Keys

The PV shall include a Customer selection keypad containing a minimum of six (6) programmable Customer-operated selection keys. The selection keys shall:

- Be made of stainless steel or other revenue service-proven materials;
- Have a flat front surface of approximately 1 square inch to provide proper finger contact;
- Not rotate;
- Provide an audible tone upon being depressed;
- Protrude no more than 0.25 inches from the face of the front panel;
- Be protected against vandalism, including impact resistance from pounding, such as by a person's foot or fist;
- Be liquid proof to provide sealed contacts for all switches;
- Not be removable from the outside;
- Be easily replaceable from the inside;
- Be spaced to accommodate labeling in conformance with ADA requirements; and
- Be non-fading.

The Customer selection buttons shall be capable of being variably defined by WMATA without outside intervention, with each button's active function defined by text displayed on the Customer graphical display adjacent to the button.

11.3.4 Transaction Status LEDs

The PV shall include three LEDs – one each in green, yellow, and red – to indicate the status of the Smart Media transaction.

- Green to indicate a valid transaction;
- Yellow to indicate a problem with processing the Smart Media; and
- Red to indicate an invalid transaction.

The LEDs shall be located on the face of the PV and shall be positioned so that they are visible in all ambient lighting conditions by the user of the PV. The LEDs shall be illuminated at the completion of the transaction for not less than two (2) seconds or until the start of the next Customer transaction, whichever is shorter.

When the PV is out of service, the red LED shall blink continuously.

11.3.5 Audible Tones

An audible tone shall be provided for the acceptance and processing of valid Smart Media. A second audible tone shall be provided for an unsuccessful transaction or upon the presentation of invalid media. These audible tones shall be settable in the field by maintenance technicians as well as at the CDS.

The PV shall be capable of emitting at least eight (8) distinct sounds or sound patterns. Tones shall be associated with transaction outcome, as follows:

- Positive tone or tones: Transaction successful, associated with solid green LED
- Advisory tones: Advisory alert, associated with solid yellow LED
- Negative tone or tones: Transaction is unsuccessful, associated with solid red LED

The tones utilized for the PV shall be the same or similar to those utilized for the Onboard Bus Payment Target (OBPT).

All sounds emitted by the PV shall be directed and of sufficient volume to be heard by the Customer in a public transit station environment. Tone volume shall be capable of being set individually in the field and via parameter downloaded from the CDS.

The sounds and sound patterns shall be demonstrated for WMATA review and approval at the Preliminary Design Review. **CDRL 11-5**

11.3.6 Voice Message System

The PV shall incorporate a Customer selection button to activate the "Audio" function for the PV. The activation of this function shall cause the information shown on the Customer display to be "read" to the Customer and provided via voice annunciation means. Until the information on the entire screen has been annunciated for the passenger, the screen shall not change due to transaction timeout or for other similar reasons, unless action has been taken by the Customer via selection of a subsequent function, by depression of a button, or presentation of Smart Media.

The information displayed shall continue to be annunciated in this manner until the "Audio" function is deactivated or the transaction sequence is complete.

In addition, when this function is activated, the Customer shall be provided with a method to increase and decrease the volume of the voice annunciation.

11.4 Electronic Control Unit

The modules within the PV shall be controlled by an Electronic Control Unit (ECU). The ECU shall also communicate via a secure network with the CDS. All items required for the PV to properly function including, but not limited to, bad and acceptable media lists, Customer display formats, configurable operating parameters, current date and time, and other such information shall be downloaded from the CDS. Transaction records and event records shall be stored in the ECU and then forwarded to the CDS based on WMATA-selectable criteria.

The ECU shall incorporate an industrial grade microprocessor assembly. Each PV shall be able to operate as both a stand-alone system and as a device that is part of a comprehensive network of NEPP equipment interfaced to the CDS.

11.4.1 Data Storage

There shall be two distinct, physically separate non-volatile memory locations for the storage of data within the device. One location shall be an easily removable and replaceable standard device (redundant memory) and the other location shall be more permanent (main memory).

The PV shall store all data from its operation in a solid-state memory module. All data sent to the CDS shall originate from this memory and all data received from the CDS shall be stored in this memory. This memory shall be unaffected by PV power status.

In cases of network failure, the PV shall have sufficient capacity to store, at a minimum, 100,000 Customer, alarm and event transactions. This information shall be stored in both the PV main memory and in redundant memory. Upon successful re-connection of network operations, all stored data (e.g., alarm, event, Customer) shall be automatically transmitted to the CDS.

11.4.2 Timeouts

The PV shall provide WMATA-adjustable time-out periods to return the PV to the idle state in prescribed times between steps of a transaction and between transactions.

- An intra-transaction time-out function shall be provided which shall limit the time between selection of a transaction type and tagging of Smart Media. If the Customer fails to tag Smart Media within a preset number of seconds after selection of the transaction type, the transaction shall automatically be canceled and the PV shall return to the idle state. WMATA shall be able to program different time spans ranging from 1 to 15 seconds in increments of 1 second for the intra-transaction time-out operation of the PV. As delivered, the intra-transaction timeout shall be set to 5 seconds.

- Similar to the intra-transaction time-out described above, an inter-transaction time-out shall also be provided. This timer shall limit the amount of time the PV waits after completion or cancellation of a transaction before resuming the idle state. The inter-transaction time-out shall be initially set to 5 seconds but shall be adjustable by WMATA from 0 to 15 seconds in increments of 1 second.

All time-outs shall be identified and the method for setting and modifying the timing settings shall be provided.

11.4.3 Operational Smart Media Lists

When the PV is communicating with the CDS, the Bad Number List stored on the CDS shall be used. When CDS communications are not available or transactions cannot be completed within the times identified in Section 3, the Invalid Smart Media List resident in the PV shall be used. The Positive Number List shall also be used to verify the validity of Smart Media, as applicable.

11.4.4 Transaction Records

The PV shall be capable of locally storing data representing no less than 100,000 transactions.

Transaction data to be stored and transferred to the CDS by the PV shall include, as a minimum:

- All completed and transactions, including all data needed to provide a complete record of the transaction;
- All invalid transactions, including reason for invalidity.

The PV shall store transaction records for each transaction performed at the PV.

Each transaction record shall include the date, time, PV number, location, and all pertinent data for the transaction.

Each transaction and summary record shall be recorded at the PV and transmitted to the CDS immediately upon communication between the two.

To protect against missed and duplicate data, each record transferred to or from the OBPT shall be serialized. Each time the PV data is successfully transferred the last transaction number shall be transferred to the CDS, and the serialized transaction number shall be automatically reset.

Each transaction record shall be unique within the NEPP system and shall include the following information as a minimum:

- Smart Media serial number;
- Date and time of transaction;

- Location;
- PV number;
- Fare Table number;
- Fare Type;
- Fare Class;
- Method of payment;
- Transaction number.

Full detailed information on all transaction and summary record information stored by the PV shall be provided as part of the data dictionary provided at the Preliminary Design Review and updated at the Final Design Review. **CDRL 11-6**

Transaction data shall be uploaded to the CDS periodically throughout the WMATA business day (times and frequency configurable by WMATA).

11.4.5 Event Records

The PV shall generate an event record for each alarm, event and maintenance action that occurs at the PV, including each of the following actions or incidents as a minimum:

- All events and alarms sensed;
- All events and alarms cleared, including the identification of the user which cleared the alarm;
- All status changes of the device or any module incorporated;
- All software and firmware version changes;
- All configuration changes;
- 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 revenues and Smart Media;

- Failures and performance incidents, for use by maintenance personnel;
- Technician log-on incidents with operator number and other log-on information;
- Technician log off;
- End of transit business day (WMATA programmable time, default is 3:00 am);
- Data transfer starts;
- Data transfer ends;
- The internal clock fails;
- The internal clock is reset;
- The PV memory is about to overflow (WMATA programmable memory percentage);
- Changing from one fare table to another;
- PV powers off;
- PV powers on;
- Successful data transfer of transactional data;
- Unsuccessful data transfer of transactional data;
- Successful download of configuration data;
- Unsuccessful download of configuration data;
- Security alarms, errors and intrusions – This information shall be stored in a separate security file at the CDS, access to which shall be protected by security password; and
- Results of automatic diagnostics.

11.4.6 Diagnostics

The PV shall be capable of detecting basic internal malfunctions. The malfunction detection shall cover at least failure of power or control circuitry, opening of an access panel, and any failure of the Smart Media read/write unit that could result in a false, incomplete, or corrupted encoding of a Smart Media.

The information displayed shall indicate the type of failure that caused the PV to shut down. A description of the maintenance and service indicators and displayed information for the PV shall be provided.

The detected deficiency shall be recorded in the PV's memory for later transfer. 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.

Upon power-up, the PV shall conduct a Power On Self Test (POST) that exercises all displays, LEDs, and audio transducers to permit the confirmation that all indicators are functioning. The POST shall also display the version of each module's application software, fare table (if applicable), and configurable parameters. During the POST, the PV shall also display the date and time of its most recent successful communication with the CDS.

Out-of-service conditions shall be annunciated on the PV Customer display. The information displayed shall indicate the type of failure that caused the PV to shut down. Method for changing this text and for setting priorities shall be provided.

11.5 Communications

The PVs shall communicate with the CDS at a frequency to meet the NEPP real-time operational requirements (or as otherwise approved by WMATA). Communications links shall include, as a minimum, communication to suit WMATA's operational and installation needs:

- Via wireless broadband communications utilizing a recognized 4G or other current standard technology for communications;
- Via integral standard Ethernet Interface with RJ45 connector(s); and/or
- Via wireless network interface built in, compliant with IEEE 802.11n and IEEE 802.11i Standard Protocols.

At a frequency acceptable to WMATA, and at a minimum at the conclusion of each day, the PV shall upload all transaction data to the CDS. At the same time, the CDS shall download data to the PV, including but not limited to the WMATA invalid Smart Media list, encoding format updates, security keys, and date/time information.

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 PV through the use of a compact flash RAM with a minimum capacity of 8GB (redundant memory).

11.6 Structure and Finish

The PV enclosure shall be constructed of non-rusting stainless steel (Grade 304L) with a random orbital finish or other revenue service proven material as identified in Section 2. Maintenance access to the PV internal components shall be via one or more panels that are secured with high-security locks and locking mechanisms. These access panels shall incorporate sensing to identify when any panel is open.

Access to the internal components of the PV shall be protected by appropriate locking devices to prohibit unauthorized access. Should unauthorized access to these internal components be gained, an intrusion alarm shall be generated and transferred to the CDS. This alarm shall have the highest priority and shall immediately be transferred from the PV to the CDS.

The PVs shall permit mounting to both a separate pedestal and to a wall, based on the needs of WMATA. The Contractor shall supply pedestals, mounting brackets and all other mounting hardware as required to ensure a secure and robust installation. A PV which can only be pole-mounted shall not be permitted.

11.7 Installation

For the rail station installations, PVs shall be installed on station platforms and at other exterior locations, which may be unsheltered from the environment. Once installed, the PV shall meet all ADA requirements.

PVs shall also be able to be installed on-board light rail and other similar vehicles. All required installation hardware shall be provided for these devices to suit the various vehicle configurations. On-board installations shall meet all ADA requirements.

The Contractor shall support installation of PVs on a minimum of ten (10) different vehicle configurations. Installation on these vehicles shall be on a stanchion. pole, post or other similar fixed location within the vehicle and shall be mounted securely to meet environmental requirements, including shock and vibration requirements as identified in Section 2.

11.8 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 11-1	Complete description of PV functionality	11.1	CDR, PDR, FDR	Yes
CDRL 11-2	Complete description of the PV physical characteristics	11.1	CDR, PDR	Yes
CDRL 11-3	Configuration and parameter settings	11.1	PDR, FDR	Yes
CDRL 11-4	Designs of the PV fixed instructions and related graphics	11.3	PDR	Yes
CDRL 11-5	Sounds and sound patterns for the audible messaging system	11.3.5	PDR	Yes
CDRL 11-6	Data dictionary	11.4.4	PDR, FDR	Yes

End of Section 11

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12 HANDHELD SALES DEVICES

12.1 General

The primary use of the Handheld Sales Device (HSD) shall be for the processing of fare media in a mobile environment within the WMATA system and obtaining account validity information from the CDS. The HSD shall process all forms of accepted and enabled fare media to ensure that a trip fare has been paid or that adequate funds are available within the Customer's Transit Account for MetroAccess, Light Rail/Street Car, Commuter Rail and Commuter Bus services, and for accommodating on-board cash and credit/debit card sales. The HSD shall also be used in other mobile locations including special events to handle the processing of accepted media for high passenger volumes.

These devices shall operate in all of WMATA's operating environments, as identified in Section 2, including outdoors where the device may be exposed to extremes in temperature and precipitation or other sources of moisture.

The HSD shall be a compact NEPP device that shall:

- Be accommodated in a single enclosure (excluding the peripheral printer) and shall be easily and comfortably held in one hand;
- Communicate with optional external modules such as a peripheral printer using the Bluetooth 2.1 communication standard;
- Process the WMATA Smart Media identified in Section 3 on board MetroAccess, Light Rail/Street Car, and Commuter Rail and Commuter Bus vehicles, at station locations as needed, and as required by WMATA;
- Accommodate on-board cash sales for Light Rail/Street Car and Commuter Rail and Commuter Bus;
- Accept and process contactless credit/debit media as a method of payment for on-board sales transactions and provide real-time wireless authorization for such transactions;

- Accept and process magnetic credit/debit media as a method of payment for on-board sales transactions using a magnetic swipe reader integrated into the peripheral printer module or other WMATA approved peripheral magnetic swipe reader;
- Encode LUM as on-board purchased fare media and sales receipts;
- Run all WMATA mobile applications as outlined in Section 5;
- Provide support for media inventory control functionality and communicate this information to the CDS;
- Be GPS enabled and automatically determine current zone based on current location using an integrated GPS module;
- Communicate with the CDS wirelessly to transmit data, receive and transmit text messages, and receive configuration and operations data via the charging/data cradle, which shall also be used to charge the HSD batteries;
- Be identified by a unique ID within the region of operation which shall be transmitted with all data exchanged;
- Satisfy all requirements of PCI for acceptance of Credit and Debit transactions.

The HSDs shall also be used by WMATA NEPP system maintainers and on-board applicable mode vehicles by WMATA and Regional partner operators and conductors, and shall operate in a transit environment as identified in Section 2. HSDs shall also be used in an outdoor environment and shall be able to perform in adverse temperatures and endure rough handling. Because the device will be carried from indoors to outdoors and outdoors to indoors, the HSD shall also be suitably rugged to withstand sudden changes in ambient temperature and humidity.

12.2 Device Requirements

12.2.1 Structure and Finish Requirements

The HSD shall be a rugged, industrialized handheld computer with data entry keys, a display screen, smart media processor and other elements needed to accommodate the functions as specified. It shall be designed for use in a commercial/industrial environment.

The HSD may alternatively be derived from a commercially available "Smart Phone" platform. With this alternate design, the primary user interface shall be through a touch screen display with no physical buttons provided. With this alternate design, all other structure and finish requirements identified in this section shall be applicable.

All physical push buttons shall be sealed to prevent particles and moisture from reaching internal components, and shall be wear resistant such that all keys remain readable over the life span of the device.

The HSD shall be designed to be easily and comfortably held in one hand. The maximum dimensions of the HSD shall be 4" wide × 6" long × 1" deep. The HSD shall weigh no more than 8 ounces, including batteries.

Conceptual drawings of the HSD showing configuration, displays, and controls seated in charging/data cradles, in the holsters and held in a hand, shall be submitted for WMATA review and approval at the Preliminary Design Review. **CDRL 12-1**

HSD hardware and software design, the functions provided, the procedures for Smart Media processing and the allocation of push buttons for each HSD and HSD printer function shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 12-2**

12.2.2 Operating System

The HSD shall utilize a handheld or mobile operating system such as:

- Blackberry OS 6 (or later);
- Windows Phone 7 (or later);
- Android 3.0 (or later); or
- iOS 4.3 (or later)

The HSD operating system shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 12-3**

12.2.3 Processor and Memory

The HSD shall be a microprocessor-based system. The microprocessor shall be no less than 1.0 GHz, commercially available and specifically designed for its intended use, that being continuous operation in the specified environment.

The HSD shall contain a minimum of 512 MB RAM and no less than 8 GB of Flash memory.

The HSD shall contain one or more expansion slots to accommodate a Secure Digital High Capacity (SDHC) expansion media card.

12.2.4 Display

The HSD display shall be a widescreen color touch-screen display measuring at least 3.5 inch (diagonal). The display shall supply a minimum resolution of 480 x 320 pixels.

The touch-screen display shall be constructed from 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.

The HSD 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.

All prompts, instructions, displays, message formats, sample character fonts, and contents shall be subject to WMATA review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 12-4**

12.2.5 Keypad

The HSD shall include a data entry keypad for selecting functions, querying stored databases, entering data and to provide other functionality required to ensure proper operation as defined herein.

This keypad shall be a QWERTY style keyboard within the HSD touch-screen display. The HSD may also include a separate QWERTY keyboard to augment the touch-screen keyboard.

Through the use of this keypad, an audible tone shall be provided with each key press. The tones shall be audible in the normal transit environments, and the volume of the tones shall be field-adjustable by the user. In addition, the HSD shall provide users the ability to disable all keyboard feedback tones. All tones shall be subject to WMATA review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 12-5**

12.2.6 Communications

The HSD shall communicate with the CDS to suit the needs of the NEPP. This shall include, as a minimum, communication via:

- Wireless Broadband System;
- Local Wireless System.

Both the Wireless Broadband System and Local Wireless System are outlined in Section 15. The HSD shall be equipped to handle communications with either system at any time. In the event that both systems are available concurrently, the HSD shall automatically defer to communication on the Local Wireless System.

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 HSD through the use of a compact flash RAM with a minimum capacity of 8GB.

12.2.7 Batteries

The HSD shall utilize one battery pack to power the device. This battery shall provide power to operate the HSD for no less than ten (10) continuous hours, with the media processor and any backlight activated no less than 50% of the time.

Two complete sets of batteries for each HSD shall be provided.

When the HSD has been inactive for a WMATA-adjustable 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 HSD is in sleep mode as described below.

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

It shall not be necessary, but it shall be possible, to remove the batteries from the HSD to perform recharging. Removal of the battery shall not require any types of tools.

Full recharging of batteries shall require no more than four (4) hours. Batteries shall not hold a recharging memory (i.e., batteries shall be able to recharge at any time for any length of time without deteriorating the recharging life of the battery).

The HSD 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.

12.2.8 Device Security

The HSD shall not be operational until a proper logon has been made to the HSD by a valid user.

To activate the HSD for use, the user shall logon to the device with, as a minimum, a username, and password. Smart Media may also be used as part of the logon process but a portion of the logon shall require data entry by the user, for security purposes.

12.2.8.1 Logon

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

- Any one of the buttons is pressed on the HSD and "User ID" is displayed, together with a prompt, on the HSD display.
- The user will enter their unique user ID, a minimum of 6 characters, and press the “ENTER” key. The HSD shall display the entered user ID. The HSD shall then display “Password.”
- The user will enter their unique password, a minimum of 6 characters, and press the “ENTER” key. The HSD 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 valid, the HSD shall display “Ready” (the HSD Idle mode) and shall be in a state to verify smart cards.

- If the combined user ID and password is invalid, then the HSD 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 HSD shall not permit logon until it has been reset by an authorized user via wireless communication with the CDS.

- Upon successful logon, the HSD shall prompt the user to enter the location/service type information for the transportation service for which the operation will occur. Location information shall be updated using the HSD GPS function. Location information shall be included as a part of all transactions.

- If the service selected is for MetroAccess, the user ID and current scheduling information provided by the CDS shall be utilized to determine the route being run by the operator. The HSD shall receive dynamic updates to trips and schedules throughout the day to allow for normal demand-response service changes, and support a list of trip statuses as defined by the CDS.

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

12.2.8.2 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 HSD shall display “Log-Off?” and a prompt.

- The user shall enter “Y” and press the “ENTER” key.

- The HSD 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 CDS as well as after a WMATA-definable time period of no activity of from one minute to eight hours.

12.2.8.3 Device Administration

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

12.3 Transaction Processing

The primary use of the HSD shall be for the processing of fare media in a mobile environment within the WMATA system and obtaining account validity information from the CDS. The HSD shall process all forms of accepted and enabled Smart Media to ensure that a valid fare is available within the customer account for the Customer and for accommodating on-board cash and credit/debit card sales. The HSD shall also be used in other mobile locations including special events to handle high passenger volumes for the processing of accepted media and to serve as a portable customer service terminal.

When used in the MetroAccess environment, the HSD shall be used by MetroAccess vehicle operators to process all forms of accepted and enabled smart media for the payment of outstanding MetroAccess fares from a customer's Transit Account.

The HSD shall access and utilize the Mobile Administration and Sales Applications from the CDS. These include the Mobile Inspection Application (MIA), the Mobile Sales Application (MSA), and the Mobile Status Monitoring Application (MSMA).

The Mobile Inspection Application (MIA) shall be used within the HSD for on-board inspection and validation of fare media in a mobile environment. The HSD shall use this application to process contactless fare media and interact with its linked or unlinked account on the CDS.

The Mobile Sales Application (MSA) shall be used within the HSD for on-board sales of fares in a mobile environment.

Using the Mobile Sales Application (MSA), the HSD shall process cash and credit/debit transactions throughout WMATA's mobile operating environment.

12.4 Reporting

In reports provided with the mobile applications, the HSD shall generate reports upon request by the user. The HSD shall be able to produce the following types of reports to support the operation of the NEPP. 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.
- Sales Report – A listing of all on-board sales transaction using the Mobile Sales Application (MSA). This shall include canceled fare sales transactions including reason for cancellation.
- Validation Report – A listing of all fare media validation transactions completed using the HSD.
- Route Reports – A listing of all routes completed under the operation of the HSD.

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 12-6**

12.5 Fare Handling Hardware

The HSD shall have a commercially available ISO/IEC-14443 compliant Type A and B contactless smart media processor (SMP) as identified in Section 3. The SMP shall be integral to the HSD. The SMP shall be modularly upgradeable so that it does not need to be replaced in its entirety to increase memory capacity, to upgrade processing performance, to provide for additional smart media functionality or to maintain compatibility with ISO/IEC-14443 standards as they develop.

The SMP external antenna shall not protrude from the exterior of the HSD enclosure and shall be made of materials that are impervious to weather conditions and resist overt vandalism.

The HSD shall have an integrated bar code scanner or imager. The bar code reader shall accurately decode barcodes at a maximum distance of twelve (12) inches from the reader to the barcode. A cell phone grade camera shall not be utilized to provide the bar code reading functionality within the HSD.

12.6 Data Entry and Storage

The HSD shall not operate without the memory module properly installed. Data stored by the HSD shall consist of individual transaction records and transaction accumulation records. Each record shall incorporate a unique number for that HSD and shall be date/time stamped. Each record shall be stored in the HSD memory for transfer to the CDS. Data shall be stored for each item of smart media processed by the HSD as well as storage of alarms and events, incidents of status change, data communication incidents and inspector logons and log-offs.

Data to be stored and transferred to the CDS by the NEPP 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 completed transactions, including payment method, and other data to provide a complete record of the transaction;
- All cancelled transactions, including reason for cancellation;

- All changes in status of the device or any module incorporated;
- All configuration changes;
- All successful communications;
- All communication failures;
- All accesses to the interior of the device; and
- Additional information required to provide a complete audit trail for revenues, fare media, and route information.

The structure, layout, and display of the records and data stored shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 12-7**

12.7 Peripherals

12.7.1 Pairing of Bluetooth Devices

The HSD shall communicate with optional external modules using the Bluetooth 2.1 communication standard.

The pairing of the HSDs with any device shall be configured and changed only via the CDS.

At no point shall the HSD or any peripheral operate in Bluetooth "Discovery Mode". Active/Inactive Bluetooth connectivity between the HSD and printer module shall be indicated using standard color-coded Bluetooth connection icons on the HSD display and through a visual indicator on each peripheral.

The paired HSDs and all paired modules shall maintain their connectivity while within the operating range, as defined for Class 1 Bluetooth devices, for no less than ten (10) continuous hours. Should the aforementioned range be exceeded and the connectivity interrupted, the paired HSD and all modules module shall automatically re-establish their connection once the devices are again within the connection range for Class 1 Bluetooth devices.

The HSD shall maintain a log of the duration of established and interrupted Bluetooth connections for a minimum of seven calendar days.

12.7.2 Printer

The HSD printer module shall be a peripheral to the HSD user interface, which prints on thermally sensitive receipt stock. The HSD printer module shall weigh no more than one pound, including rechargeable batteries and a complete roll of receipt stock.

The HSD printer module shall optionally include an integrated magnetic swipe reader to accept and process magnetic credit/debit media as a method of payment for on-board sales transactions and in other mobile locations as required by WMATA. The magnetic swipe reader shall be a peripheral to the HSD user interface.

The HSD printer module shall be able to operate continuously for any of WMATA's currently scheduled Operator's shifts, and a minimum of 10 hours on a single battery charge. Two complete sets of batteries for each HSD printer shall be provided.

The use of a printer module that is integrated with the HSD is prohibited.

The HSD printer shall be used for printing the following items:

- Bar codes as required for specific documents printed, such as shift reports;
- Receipts for sales transactions (automatic as required as well as on-demand as requested by the Customer, including signature receipts);
- Shift reports and other reports;
- Citations for non-paying Customers, as appropriate;
- Warnings for non-payment; and
- Other reports as required by WMATA.

The printer shall be able to print all alphanumeric characters in both upper and lower case. Printed characters shall be produced with a minimum height of 0.12 inches and a height up to 1.0 inch. The approximate height to width ratio of the characters shall be 5:3. The printer shall print on a single roll of commercially-available, standard, continuous thermal paper, nominally 2-1/4 inches wide and 75 feet in length. The HSD shall issue receipts which meet all Regulation E requirements and other banking standards promulgated by the American Bankers Association.

WMATA shall be able to modify and restructure the receipts and reports issued using the CDS to provide new report and receipt formats.

The printer module shall be a separate, un-tethered unit utilizing Bluetooth communication with the HSD user interface. Pairing of the printer module with the HSD shall be governed in accordance with Section 12.7.1.

The printer module shall be activated by the HSD via input from the operator. It shall not be necessary to manipulate or otherwise activate the printer module in any way to print any reports.

12.7.3 Magnetic Swipe Reader

A magnetic swipe reader shall be provided as an integrated component of the HSD printer module or other WMATA approved peripheral. It shall be a peripheral to the HSD user interface, with which magnetic credit/debit media is accepted and processed as a method of payment for on-board sales transactions and in other mobile locations as required by WMATA.

12.8 Recharging System

Using individual charging cradles or multi-device charging stands, WMATA shall be able to charge simultaneously the batteries installed in all HSDs and an equal number of spare batteries (i.e., a spare battery for each HSD). The HSD charging cradles shall also provide data exchange capabilities with the CDS while HSDs are in the cradles.

Similarly, using individual charging cradles or multi-device charging stands, WMATA shall be able to charge simultaneously the batteries installed in all HSD printers and an equal number of spare HSD printer batteries (i.e., a spare battery for each HSD printer).

12.9 Holsters

Each HSD shall be supplied with a sturdy holster to hold the device. The holster shall be made of leather, nylon, or other sturdy material, and shall securely hold the HSD on the operator's belt. While in the holster, the HSD shall be completely covered, and a clasp or hook-and-loop fastener shall retain the holster cover in place over the HSD.

Similarly, the Contractor shall supply a holster for each HSD printer. The holster shall be made of leather, nylon, or other sturdy material, and shall securely hold the HSD printer on the operator's belt. Alternatively, in lieu of a belt attachment, the holster may include a separate shoulder strap. While in the holster, the HSD printer shall be secured with a clasp or hook-and-loop fastener, and the HSD printer shall be able to issue receipts.

Design of the holsters shall be submitted for WMATA review and approval at the Preliminary Design Review. **CDRL 12-8**

12.10 Additional Functions

The HSD shall also provide the user with the following functionality:

- Override the automatic location information generated by the GPS, on an as-needed basis, to accommodate the difference in location between where a customer may have boarded a vehicle and when the customer-user/HSD interaction occurs; and
- Operate all applications from the CDS (Section 16) through an internet web browser, via the wireless communications connection (Section 15) including customer service applications, information regarding arrival or service disruptions, as well as advertising.

In addition, the HSD shall provide for strict accounting of all smart media sales and shall include summary data as well as transactional data storage. The HSD shall accumulate fares by customer type, payment type, media type, and other categories as required by WMATA. These categories will be identified by WMATA prior to the Preliminary Design Review. **CDRL 12-9**

The Operator shall be able to review all media sales made through the HSD since the last operator remittance. In addition, a function shall be included to provide the amount of cash to be remitted at any time desired. This function shall require an additional logon with a different password for increased security.

12.11 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 12-1	Provide conceptual drawings of the HSD showing configuration, displays, and controls seated in charging/data cradles, in the holsters and held in a hand.	12.2.1	PDR	Yes
CDRL 12-2	Provide HSD hardware and software design, the functions provided, the procedures for Smart Media processing and the allocation of push buttons for each HSD and HSD printer function.	12.2.1	PDR, FDR	Yes
CDRL 12-3	Provide the HSD operating system details.	12.2.2	PDR, FDR	Yes
CDRL 12-4	Provide all HSD display prompts, instructions, displays, message formats, sample character fonts, and contents.	12.2.4	PDR, FDR	Yes
CDRL 12-5	Provide all audible tones to be used for key presses of the QWERTY style keyboard within the HSD touch-screen display.	12.2.5	PDR, FDR	Yes
CDRL 12-6	Provide samples of all reports produced with the HSD mobile applications.	12.4	PDR, FDR	Yes
CDRL 12-7	Provide the structure, layout, and display of the records and data stored by the HSD.	12.6	PDR, FDR	Yes
CDRL 12-8	Provide the complete design of the HSD holster.	12.9	PDR	Yes
CDRL 12-9	Provide the summary and transactional data to be stored by the HSD, such as fares accumulated by customer type, payment type, media type, and other categories as required by WMATA.	12.10	PDR, FDR	Yes

End of Section 12

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13 CUSTOMER SERVICE TERMINALS

13.1 General

Customer Service Terminals (CSTs) shall be delivered as part of the New Electronic Payments Program (NEPP) and shall provide for fare media and Transit Account support, and the distribution and sale of fare media to WMATA customers.

The CST shall support three modes of operation, described herein:

- Full-function CST;
- Customer Sales Device (CSD);
- Station Support Terminal (SST).

The CST shall be based on a ruggedized desktop computer system, suitable for the defined functionality and shall employ the latest commercially available version of Windows® Operating System and utilize Windows®-based software. Each device shall be capable of utilizing WMATA's standard security suite software and shall comply with WMATA Policy/Instruction 15.16/0 regarding Antivirus Software.

The CST shall allow authorized users to issue fare media, register customers, add passes and stored value to accounts and provide information on fare media usage history. The CST shall also enable authorized users to establish linked accounts for customers (i.e. link an external form of payment to a customer account), modify account parameters, and configure auto-replenish set-ups. The CST shall be the primary device for obtaining reduced fare eligible media, including Senior and Disabled passes.

In addition, the CST shall allow authorized users access to research media/account history, correct erroneous charges add or remove fare media from the invalid fare media list and access all web based NEPP Customer Service Applications (CSAs) as defined in Section 5. The CST shall be able to cancel fare media, and subsequently issue / enable replacement smart / accepted fare media, including all products accessed by the fare media and links to external forms of payment, on the account.

A complete description of the functionality of CST shall be provided for WMATA review and approval at each stage of the design review, with the final document fully describing the operation, capabilities, and functionality as described within this section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 13-1**

13.2 Functionality

13.2.1 Full-Function CST Mode

When configured as a full-function device, the CST shall provide the following functionality:

A. Communicate with the CDS to transmit and receive data on transactions and revenue, equipment status and activity, and to receive commands, transmit and receive data regarding sales, revenue, accounting, status, and security information automatically and/or on a scheduled basis;

B. Respond to all operator inputs;

C. Display fare media account validity and value information during and upon completion of a transaction;

D. Display fare media account validity and value information upon request by the customer and permit the validity to be printed for the customer;

E. Provide different audible annunciations for valid and invalid transactions;

F. Create and store transaction data for all activities and events;

G. Provide support for customer payment of daily parking privileges at WMATA-owned parking lots and garages, including the entering of all information needed to pay for that parking privilege (see Section 14);

H. Establish a new customer account using the account setup function at the CDS as identified in Section 16;

I. Issue new smart media;

J. Provide customer registration of fare media;

K. Link WMATA or Partner-issued smart media to a customer-managed WMATA Transit Account;

L. Link an external financial account to a WMATA Transit Account for replenishment purposes;

M. Link monthly parking privilege to a customer Transit Account;

N. Delink fare media from an account (internal or external linking);

O. Issue smart media associated with a Transit Account, including customization of such media with reduced fare privileges such as Senior and Disabled passes, and printing of customer picture on media, as required;

P. Add unlimited ride passes, stored value, and stored trips to a WMATA Transit Account;

Q. Account for SmartBenefits, EZ-Pay, cash and check payments for fare media purchases;

R. Process and account for credit and debit card payments for fare media purchases;

S. Reverse customer transactions, including credit/debit transactions;

T. Provide customer reports on WMATA account activity;

U. Research media/account history and correct erroneous charges in response to customer queries;

V. Enable customers to report registered fare media as lost or stolen and to obtain and enable replacement smart and accepted fare media for the same account;

W. Utilize an external PIN pad and electronic signature pad capable of being mounted outside of the customer service booth protective window to facilitate credit and debit card payments for fare media purchases;

X. Print receipts (with complete transaction information) for customers upon request; and

Y. Print local sales and fare media transaction activity reports.

Z. Provide users with access to the web-based NEPP applications as permitted by the user's permissions and authorizations, such as the Customer Service Application (see Section 22).

13.2.2 Customer Sales Device Mode

The CST shall be capable of operating in a sales device mode only, in which case the CST shall be defined as a Customer Sales Device (CSD). The CSD shall be deployed at non-WMATA owned and operated sales locations such as Preferred Vendor sales locations. At such locations, customer support services shall be a minimum. User access privileges shall allow the functionality identified in items A through Y in Section 13.2. The operator shall be provided with access to the web-based Customer Service Application for the use of applications only in direct support of fare media sales.

The CSD shall be differentiated from the CST by the user permissions defined for individual terminal operators and user groups, as well as the peripherals attached to the terminal. The CSD shall utilize only a touch screen device to accept operator input (see Section 13.6). The terminal shall automatically configure its software and mode of operation as a CSD based on the peripherals detected and the user log-in provided when powered up.

The CST shall permit the addition of value to an account through the entry of information, with all such additions, subtractions or other changes reported in a secure audit report available to authorized personnel. These audit report shall not be able to deleted from the NEPP and shall be maintained with the appropriate financial records within the NEPP. This report shall include all information needed to provide complete auditability, as selected by WMATA.

The NEPP shall also receive data from the WMATA Nextfare 5 data warehouse to provide for the addition of value stored on magnetic WMATA fare media to a selected account. At no time shall the data from the same magnetic media be added to more than a single account and when the data transfer is made to the account, this shall be identified in the NEPP Data Warehouse.

13.2.3 Station Support Terminal Mode

The CST shall be capable of operating in the Metrorail station environment as a CST with limited functionality, in which case the device may be defined as a Station Support Terminal (SST). The SST shall be deployed within the Station Manager kiosk within each Metrorail station. At such locations, customer support services and NEPP applications to be accessed shall be defined by Station Manager user privileges. The SST shall however be capable of providing all functionality identified in items A through Y in Section 13.2.

The SST shall be differentiated from the CST by the peripherals attached to the terminal, in addition to the user permissions defined for individual terminal operators and user groups. The SST shall include all peripherals and hardware to process and validate all fare media accepted as part of the NEPP. The SST shall utilize only a touch screen device to accept operator input (see Section 13.6). The terminal shall automatically configure its software and mode of operation as an SST based on the peripherals detected and the user log-in provided when powered up.

13.3 Transaction Processing

The CST shall be able to issue and process transactions and fare media as outlined in Section 3 based on the system needs as determined by WMATA.

Selection of functions to be accessed by an authorized CST user shall be customized to each user based on their level of access privileges. User and group access privileges shall also restrict the use of the CST to Customer Sales Device (CSD) mode.

The Contractor shall provide all information on the hardware and peripherals for the sale device elements identified in this section for WMATA review at the Conceptual Design Review and for approval at the Final Design Review. **CDRL 13-2**

The CST shall accept all methods of payment as outlined in Section 4. In addition, the CST shall provide summaries of the payments made for all customer purchases. These summaries shall be based on each of the methods of payment accepted.

The CST shall process all account-based transactions when the CST is in communication with the CDS. Parameter driven thresholds and permissions shall be used to process fare media and their associated accounts when the CST is not in communication with the CDS.

Whenever fare media presented to the CST is on the Invalid Fare Media List, a visual notification of the event shall be provided to the terminal operator in conjunction with a distinct audible annunciation indicating fare media invalidity. The CST shall permit the status of the Transit Account linked to the fare media to be printed for the customer. The CST shall record the event. The "invalid media presented" event record shall include the CST device number, date, time, fare media serial number as well as the status code of the Invalid Fare Media status.

13.4 Fare Table

The CST shall have the ability to operate under any of a minimum of two (2) fare tables residing in CST memory. Each of these fare tables shall be programmable to become the active set at a particular time and date and to expire at a particular time and date as well. They shall provide for pre-loading new fare tables for new fare levels and to implement short-term or temporary special fares (e.g., special event service or special fares for a day). The Contractor shall provide details on the fare table configuration, set-up, and capacities. **CDRL 13-3**

13.5 Control System

The CST shall be a microcomputer-based device with the necessary peripherals to perform the required functionality. The CST shall utilize a third-party processor as the Electronic Control Unit (ECU), which shall control all functional aspects of the device.

In addition to configuration-specific peripherals, each CST shall include but not be limited to the following hardware specifications:

A. Minimum of Intel Core i5 Microprocessor or approved equal;

B. 4 GB of system memory;

C. Minimum of 4 USB 3.0 ports;

D. Built-in Network Interface Card (NIC) to support Ethernet based network connectivity.

The general architecture of the CST, including CPU and bus speed speeds, memory size and speed, shall be designed to meet the functional requirements of the CST and shall be provided to WMATA for review and approval. **CDRL 13-4**

The CST shall use solid-state memory with sufficient capacity to store a minimum of 1,000,000 transaction records.

The CST shall operate using 115V AC power and shall utilize appropriate power conditioning to ensure proper operation.

Data shall be stored for each transaction performed by the CST and securely transmitted to the CDS. All transactions shall be associated with the user signed-on when the transaction occurs.

The CST shall be capable of reading the information on the fare media without modification, upon selection of the “Read” function by the user.

The CST shall maintain date and time of day by an internal clock which shall have a battery, or equivalent, backup to keep the clock running for at least 150 hours without input power. The clock shall maintain time to an accuracy of less than one-minute error within a one-year period. Time shall be synchronized between the device and the CDS each time data transfer occurs, regardless of the time depicted.

All configuration and parameter settings including fare table control group assignments, payment options, offline thresholds and log-on information shall be obtained by the CDS and shall be configurable within the CDS.

A complete description of the CST shall be provided for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality as described within this section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 13-5**

All configuration and parameter settings shall be subject to WMATA review at the Preliminary and approval at the Final Design Reviews. **CDRL 13-6**

Dimensioned drawings of the CST showing configuration, displays, and controls shall be submitted for WMATA review and approval at the Preliminary Design Review. **CDRL 13-7**

13.6 User Interface

The CST shall be designed to provide quick transaction processing for all fare media, from selection of the fare to the issue of receipt after payment.

The CST shall allow the operator to access a customer's Transit Account via:

- Using the Payment Processing Target to read the customer's Smart Media;
- Entry of account data using standard input fields including but not limited to fare media identification or serial number, account holder credentials, etc.

The CST shall securely process credit and debit media using a peripheral device or integral processor, together with an external customer PIN pad and electronic signature pad capable of being mounted outside of the customer service protective window.

A flat panel display shall be used for all displayed messages, status indicators, and prompts (Section 13.7.1).

Operator input shall be performed via a wireless keyboard and pointer device, and via a touch screen device. When deployed in the CSD mode of operation, operator input shall be performed via a touch screen device only.

In addition, a minimum of ten (10) WMATA definable function keys shall be provided on each device.

The allocation of the buttons for each of the CST functions shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 13-8**

13.7 Peripherals

The CST shall incorporate various peripherals based on the installation location and required functionality. The CSTs shall automatically configure its software based on the peripherals detected when powered up.

A complete description of all CST peripherals shall be provided for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality as described within this Section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 13-9**

Dimensioned drawings of the CST and all peripherals, showing configuration, displays, and controls shall be submitted for WMATA review and approval at the Preliminary Design Review. **CDRL 13-10**

13.7.1 LCD Touch Screen

All CSTs shall have a commercially 17" (or larger) TFT Active Matrix LCD Touch Screen Display. This LCD Touch Screen shall be ruggedized, sufficiently hardened, and scratch-resistant to withstand the transportation and sales environment for which it will be deployed over the life span of the device, without the need for replacement.

The LCD Touch screen shall meet the following criteria:

A.	Viewing Angle	160° (Horizontal)
		160° (Vertical)
B.	NEMA Rating	5

13.7.2 Media Processing Hardware

All CSTs shall include a Payment Processing Target (PPT) as identified in Section 3. The CST's PPT shall be installed in a compact, separate enclosure that enables it to be conveniently placed for use by the operator. The PPT antenna shall be beneath the top surface of the module, which shall be flat to permit the operator to leave the Customer's Smart Media in place while operating the CST.

All cables between the CST and the PPT enclosure shall be suitably rugged and secure.

13.7.3 Cash Drawer

All CSTs to be deployed at WMATA sales and service offices and at Preferred Vendor sales locations shall be delivered with a cash drawer, which shall securely hold cash associated with payment of transactions. The cash drawer shall be interfaced with the CST. The CST shall control the opening of the cash drawer. When closed, the cash drawer shall automatically lock.

Reconciliation shall be provided for the cash drawer with the funds collected for CST fare media transactions. This information shall be included on the Remittance Report.

13.7.4 Printer

All CSTs to be deployed at WMATA sales and service offices and at Preferred Vendor sales locations shall be delivered with a printer to issue a receipt of the transaction to the customer following transaction completion as well as for providing a printout of fare media transaction history information. The printer shall utilize thermal printing technology to print on a single continuous roll of thermally-sensitive paper. The printer shall be designed for easy loading of a new paper roll when the current one is empty, and shall have a cutting edge for cleanly and accurately tearing off the receipt by the operator to give to the customer.

13.7.5 Remote Customer Display

All CSTs to be deployed at WMATA sales and service offices and at Preferred Vendor sales locations shall be delivered with a remote customer display. The remote customer display shall be a device connected to the CST by a cable, which displays the sales information to the customer. The customer display shall provide at least two lines with 40 characters each, using LED or other commercially available high visibility display technology. Information displayed shall include data on each item of fare media that is part of the transaction, the total owed, the number of items of fare media to be provided to the customer, the change due as well as other transaction information, which may be deemed necessary by WMATA.

The Contractor shall ensure that WMATA can modify the messages displayed for each type of fare media through the CDS.

13.7.6 Digital Camera

The CST shall be capable of being connected with an optional digital camera. The CST shall be designed to enable it to be connected to a Contractor-supplied, commercial grade digital camera and printer/encoder/issuer that can be used for issuing personalized smart media for designated customers, including, but not limited to, employees, senior citizens, persons with disabilities, students, and police.

13.7.7 Smart Media Photo Printer

The CST shall be capable of being connected with an optional Smart Photo Printer. Equipment shall be provided to print graphics on smart media and issue them for usage within the NEPP. This equipment shall:

- Be desktop mounted;
- Permit printing specified information on the cards (including digitally stored photographs);
- Automatically overlay each printed card with a transparent film to protect the printed image;
- Print and overlay cards at a minimum rate of 75 cards per hour;
- Interface to the CDS for data transfer purposes;
- Permit feeding the smart media one-by-one and in bulk, through the use of stackers/hoppers; and
- Automatically shut down after a pre-determined idle time.

Edge to edge printing shall be provided in full color at a resolution of at least 300 dots per inch using revenue service-proven technology.

The Smart Media Photo Printer may utilize ribbon rolls for printing. Ribbon rolls for each specific color or one color zone printing are acceptable. For either configuration, each roll utilized shall accommodate printing for a minimum of 350 items of smart media.

13.8 Reports

In addition to receipts, the CST shall print reports upon request by the user. The CST shall be able to produce the following types of reports in order to support the operation of the NEPP:

- Transaction summary report – A summary of all fare media verifications, smart media sold, and revenues collected during the user's shift.
- Transaction detail report – Prints the last 10 transactions for the fare media presented.
- Maintenance report – A listing of all maintenance issues, which have arisen since maintenance was last performed for the device.
- Supervisor report – A listing of all users, which have signed on to the device, a summary of the revenue collected, and smart media issued by each user. This shall also include sign-on failures and other similar transactions. These reports shall be uniquely serialized.
- Remittance report – A report that provides details of the revenues remitted by the user. These reports shall be uniquely serialized.
- Shift report – A report that provides details of sales and counts of smart media verifications performed during the shift, and including those sign-ons and sign-offs which have occurred between remittances.

The Contractor shall provide a minimum of five additional reports, as defined by WMATA at the Final Design Review. Contractor shall provide samples of these reports for WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 13-11**

13.9 Communications

The CST shall communicate with the CDS in on-line manner to transmit and receive all necessary information. The status of communications between the CST and the CDS shall be constantly displayed as part of the GUI of the CST and shall be visible at all times by the CST operator on the flat panel display provided (see Section 13.7.1). This information shall include:

- All transactions and revenue data;
- Equipment status and activity, and to receive commands, transmit and receive data regarding sales, revenue, accounting, status, and security information automatically on a scheduled basis;
- Clock synchronization commands;
- Invalid fare media lists;
- Fare tables;
- Configuration parameters; and
- Software updates for the CST and attached readers and peripherals.

The above information shall be communicated between CST and the CDS both automatically at a scheduled time and manually upon selection by the authorized user.

Communications for the CST shall be via the WMATA NEPP Communications Network (see Section 15).

Data communications shall be provided at each installation location for each CST. The CST shall only be capable of data communications direct with the CDS. All data transmitted between any sales devices and the CDS shall be encrypted.

All CSTs shall be capable of being configured to communicate with the CDS via the following methods:

- Ethernet (RJ45) Interface with the WMATA Communications Networks;
- Standard IEEE 802.11n Wireless LAN and IEEE 802.11i security measures, with the WMATA Communications Networks; and
- Via the WMATA NEPP Wireless Broadband network.

The above outlined systems are discussed in detail in Section 15. The communications systems shall be supported in each CST through the use of a commercially available network card, utilizing a standard PC card interface, such as PCI or PCMCIA.

When data transfer of CST data is successfully completed and the CDS acknowledges receipt of the data, all resettable transaction, event, and alarm data in the CST memory shall be cleared. Data in non-resettable registers shall not be cleared.

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 CST through the use of a compact flash RAM with a minimum capacity of 8GB.

13.9.1 Data Transmission

Communications for the CST shall be via the WMATA network and connection shall be required before the CST is permitted to begin operations. Each time a user logs in to or out of the CST, data transfer shall occur before any additional functions may be performed.

The CST shall accept any updates to any information, parameters, or files stored locally from the CDS at any time. Immediately following the completion of any current transaction, the CST shall update and install these files, should such files be identified and available.

The portable CST (PCST) shall communicate with the CDS to process all fare media and their associated accounts via the NEPP Wireless Communications Network (Section 13.11.1).

13.9.2 Events and Alarms

Data to be stored and transferred to the CDS by this NEPP device shall include as a minimum:

- All events and alarms sensed, including access to prohibited functions;
- All events and alarms cleared, including the identification of the user who cleared the alarm;
- All completed transactions, including payment method, change issued, monies inserted and other data to provide a complete record of the transaction;
- All cancelled transactions, including reason for cancellation;
- All changes in status of the device or any module incorporated;
- All configuration changes;
- All changes in software and tables version being used;
- All successful communications;
- All communication failures;
- All commands issued by the maintenance, revenue service and other personnel.

13.10 Structure and Finish Requirements

The CST shall operate in an indoor environment and shall not normally be subject to adverse humidity, temperatures, or temperature fluctuations. Nevertheless, the CST shall be suitable for use in a commercial/industrial environment. The device software shall be able to be configured remotely by WMATA from the CDS to identify the smart media to be sold and fare media to be processed for each individual location. This shall permit WMATA to, at any time, revise the type of smart media sold or fare media processed at any location or device to suit WMATA's changing needs.

The CST shall be capable of detecting basic internal malfunctions and shall annunciate failures immediately to the CDS. The malfunction detection shall cover at least failure of power or control circuitry, and any failure of the smart media read/write unit that could result in a false, incomplete, or corrupted encoding of smart media.

The CST shall be based on a desktop PC with required peripherals. The CST and its peripherals shall be third-party commercially available devices. The CST peripheral devices shall be designed to operate in an environmentally controlled office location. The CST shall automatically configure itself, based on the peripherals connected, including a cash drawer. Communication shall be through the NEPP data networks outlined in Section 15.

13.11 Portable Equipment

13.11.1 Portable Customer Service Terminal

A portable version of the Full-function CST shall be provided. It is the intent that the Portable CST (PCST) will provide WMATA with all of the functionality of the CST, as outlined in Sections 13.1 through 13.6.

The PCST shall communicate with the CDS to process all fare media and their associated accounts. This shall include, as a minimum, communication:

- Via the Wireless Broadband System;
- Via the Local Wireless System.

The Wireless Broadband System and Local Wireless System are outlined in Section 15. The PCST shall be equipped to handle communications with either system at any time. In the event that both systems are available concurrently, the PCST shall automatically defer to communication on the Local Wireless System. The PCST shall be capable of processing transactions based on the stored fare tables that do not require real-time account access. However, off-line operation of this device shall only be available for a user with supervisor privileges, and the device shall require connection to the WMATA network to upload the data upon completion of the off-line transactions.

In addition, the PCST shall be capable of communicating wirelessly with a Digital Camera (Section 13.7.6) and Smart Media Photo Printer (Section 13.7.7).

A complete description of the functionality of PCST shall be provided for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality as described within this Section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 13-12**

13.11.2 Mobile Sales Device Cabinet

The CST and all of its peripherals shall be capable of being securely stored and transported within a mobile cabinet. This Mobile CST Cabinet shall be industrial grade with a powder coated finish, and be mounted on casters; two casters shall be fixed and two shall pivot. The fixed casters shall include foot-actuated locks.

This mobile cabinet shall feature an upper and lower compartment, as well a slide-out keyboard drawer. Within these compartments, there shall be provisions for securely mounting a CST and all available peripherals. Covers for each compartment shall include high-security locks.

When deployed, the cabinet shall incorporate two foldout shelves to provide a suitable workspace for Sales Agents. The cabinet shall be designed such that heavier peripherals such as the UPS and printer(s) shall be located on the lower shelves of the cabinet. The CST and all peripheral shall be operable without having to be removed or unpacked from the mobile cabinet.

Operation of the CST and peripheral devices within the cabinet shall require the main cabinet access door to be in the open position. The cabinet door shall be designed such that while in the open position, it may be fixed in the open position or securely latched to an external panel of the cabinet, to prohibit free pivoting of the cabinet door. The mobile cabinet shall be designed such that during the operation of the CST and all peripherals contained within the cabinet, the open door configuration allows sufficient ventilation to be provided to all devices within the cabinet to maintain safe and reliable operation of those devices without the need for environmental conditioning components to be supplied within the mobile cabinet.

All electronics equipment shall be connected with a central power distribution module, which receives power from one electrical cord. This power distribution module shall provide power conditioning and surge protection to protect all electrical equipment within the cabinet.

The Mobile CST Cabinet shall meet the following criteria:

A.	Unloaded Weight	50 lbs. (maximum)
B.	Height	54 in. (maximum)
C.	Width	24 in. (maximum)
D.	Depth	18 in. (maximum)
E.	NEMA Rating	4
F.	IP Rating	54

In addition, the mobile cabinet shall be designed to be stable under unloaded conditions as well as when loaded with the CST and any of the required peripherals. The cabinet shall not tip over with any or all slide-out shelves, whether individually loaded or unloaded, partially or fully extended from the its storage area.

A complete description of the Mobile CST Cabinet shall be provided for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality as described within this Section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 13-13**

13.12 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 13-1	Provide a complete description of the functionality of CST with sufficient detail to permit verification that all required functions are satisfactorily included.	13.1	CDR, PDR, FDR	Yes
CDRL 13-2	Provide all information on the hardware and peripherals for the sale device elements of the CST.	13.3	CDR, FDR	Yes
CDRL 13-3	Provide details on the CST fare table configuration, set-up, and capacities.	13.4	PDR, FDR	Yes
CDRL 13-4	Provide the general architecture of the CST, including CPU and bus speeds, memory size and speed.	13.5	PDR	Yes
CDRL 13-5	Provide a complete description of the CST operation with sufficient	13.5	CDR, PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
	detail to permit verification that all required functions are satisfactorily included.			
CDRL 13-6	Provide all configuration and parameter settings for the CST.	13.5	PDR, FDR	Yes
CDRL 13-7	Provide dimensioned drawings of the CST showing configuration, displays, and controls.	13.5	PDR	Yes
CDRL 13-8	Provide the allocation of the buttons for each of the CST functions.	13.6	PDR, FDR	Yes
CDRL 13-9	Provide a complete description of all CST peripherals with sufficient detail to permit verification that all required functions are satisfactorily included.	13.7	CDR, PDR, FDR	Yes
CDRL 13-10	Provide dimensioned drawings of the CST and all peripherals, showing configuration, displays, and controls.	13.7	FDR	Yes
CDRL 13-11	Provide samples of all reports produced by the CST.	13.8	PDR, FDR	Yes
CDRL 13-12	Provide a complete description of the functionality of the PCST with sufficient detail to permit verification that all required functions are satisfactorily included.	13.11.1	CDR, PDR, FDR	Yes
CDRL 13-13	Provide a complete description of the Mobile CST Cabinet.	13.11.2	CDR, PDR, FDR	Yes

End of Section 13

Section 14 – Parking Systems
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14 PARKING SYSTEMS

14.1 General Information

Parking fees are collected for parking by WMATA at their parking facilities. There are two configurations: free entry with pay on exit; and pay on entry with free exit. The parking system is presently controlled by parking software installed at the Parking Operations Center.

Each payment lane shall incorporate a new Payment Lane Processor (PLP), which shall interface with the vehicle detection system and parking gate as well as the parking software installed at the Parking Operations Center. The NEPP System shall provide for parking processing and fee payment in a manner similar to the existing methodology, but process all payment methodologies as identified in Sections 3 and 4. Parking fee payments shall be separately identified from transit payments within the NEPP.

The PLP shall also include the required hardware and software to process magnetic stripe-based credit cards. Activation/deactivation of the ability to process magnetic stripe-based credit cards shall be based on parameters which shall be settable by WMATA at the CDS and downloaded to the PLP. If the this magnetic stripe-based credit card processing is not activated, then this shall have no impact on contactless credit card processing.

All present parking gates and vehicle detection systems system will be fully operable and controllable from a remote WMATA centralized Parking Operations Center. The PLP shall be monitored and controlled by the NEPP Central Data System (CDS).

The Contractor shall provide a complete description of the functionality of the parking system, including transaction processing and recording, for WMATA review and approval at each design stage. Design documents shall fully describe the operation, capabilities, and functionality as defined within this section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 14-1**

The Contractor shall provide a complete description of the PLP physical characteristics including all materials, finishes, components, module details (manufacturer, model number, software/firmware version), dimensioned drawings, exploded drawings and other information to permit WMATA to understand which specific items of

hardware are being used within the PLP and their configuration. **CDRL 14-2**

All configuration and parameter settings shall be subject to WMATA review and approval at the Preliminary and Final Design Reviews. **CDRL 14-3**

14.2 Present Operation

WMATA operates parking facilities at 42 Metrorail stations as follows:

- All 42 stations offer daily or hourly parking;
- 35 stations presently offer reserved parking, where customers purchase permits to park in reserved spaces;
- Parking at Metro-operated lots is free on weekends and Federal holidays;
- Where pay-upon-entry parking is used, fees for daily parking are collected upon entry 5am through 2pm Monday through Friday;
- Where pay-upon-exist parking is used, fees for daily parking are collected upon exit between 10:30 a.m. and midnight Monday through Thursday and from Friday 10:30 am to Saturday 3am; and
- Short-term metered parking costs $1 per hour.

Payment of parking fees varies based on parking location. At all parking locations SmarTrip® cards are presently accepted. SmarTrip® cards are the only form of payment accepted at all daily parking lots. Major credit cards are also accepted at many parking locations, and credit card payment is planned for all locations by the end of June 2011.

Payment by credit card is via magnetic stripe readers installed next to the existing SmarTrip® card target readers on the side of the booth: The following credit cards are accepted:

- Discover;
- MasterCard;
- Visa;

- American Express; and
- Japanese Credit Bank.

Multi-day parking is available at three stations: Greenbelt, Huntington, and Franconia-Springfield. There is presently no charge for multi-day parking beyond the regular fee when paid with a SmarTrip® card on the day of exit if exiting during collection hours.

14.3 Payment Lane Processor

A Payment Lane Processor (PLP) shall be installed in each payment lane for the processing of parking fees. The PLP shall accept payments from Smart Media

When the PLP is communicating with the CDS, the Bad Number List stored on the CDS shall be used for all Smart Media Payments. When CDS communications are not available or transactions cannot be completed within the times identified in Section 3, the Invalid Smart Media List resident in the PLP shall be used. The Positive Number List shall also be used to verify the validity of Smart Media, as applicable.

Each payment lane shall incorporate a new PLP which interfaces with the vehicle detection system and parking gate. Non-payment lanes shall not be modified.

14.3.1 Payment Processing Target

Each PLP shall have a commercially available ISO/IEC-14443 compliant Type A and B contactless Payment Processing Target (PPT) as identified in Section 3.

The PPT shall be modularly upgradeable so that it does not need to be replaced in its entirety to increase memory capacity, to upgrade processing performance, to provide for additional Smart Media functionality or to maintain compatibility with ISO/IEC-14443 standards as they develop.

14.3.2 Receipt Issuing System

A receipt printer shall be provided to print receipts as required by WMATA and upon request by the Customer. It shall be able to print all alphanumeric characters in both upper and lower case and shall print only one receipt per payment transaction.

Receipts shall be dispensed from a slot on the face of the PLP when the Customer presses the receipt issue button on the face of the PLP. The button shall be clearly identified with WMATA-approved graphics that it is a receipt issue button. Issue of a receipt shall require proper vehicle presence in the lane.

Printed characters shall be produced with a minimum height of 0.12 inches. The approximate height to width ratio of the characters shall be 5:3. The printer shall be of the direct thermal type. Receipt rolls shall be shall be available from commercial office supply store chains. The receipts shall not be fully cut but shall require effort by the Customer for their removal from the

The receipt printer shall include facility, date, time, equipment number, transaction sequence number and fee paid for all transaction receipts. Additional information to meet the above identified Federal regulations shall be included on selected receipts, where required.

The receipt shall also provide for a minimum of four (4) lines of static text to be printed on the top and bottom of the receipt. The text for these lines shall be defined by WMATA and each line shall have capacity of a minimum of fifteen (15) characters per line.

All data and text to be printed, as a part of the receipt shall be selectable and changeable by WMATA. Method for changing receipt information shall be provided.

14.3.3 Customer Display

The PLP shall incorporate customer display to convey equipment and transaction status and other information to the Customer. This display shall display a minimum of forty (40) characters, based on two lines of 20 characters each with a character height of not less than 5/16 of an inch each.

The customer display messages shall be readable within five (5) feet from the PLP under operating conditions typical at the parking facilities without need for baffles or other similar components.

The messages to be displayed shall be defined in the CDS and shall be definable and modifiable by WMATA, without the need for assistance by the equipment supplier. Methods for modifying the messages displayed and the triggers for those messages shall be provided.

14.3.4 Control System

The PLP shall be controlled by an integrated Electronic Control Unit (ECU). The ECU shall be industrial grade, modular, commercially available and specifically designed for the intended use of being in continuous operation for the specified environment and shall control all aspects of the PLP, including communication via a secure network with the CDS.

The CDS shall be capable of downloading updated application software to the PLP. Upon receipt of new application software, the PLP shall automatically reset and begin operation with the new application software. Data transfer between the PLP and the CDS shall be as identified in Section 14.4. All authorization request responses, fee tables, operational parameters, settings, lists and other such information shall be received from the CDS.

All data shall be stored in the PLP main memory and shall not be overwritten or modified until all data is successfully transferred to the CDS. The main memory shall have sufficient capacity to locally store the Operational Smart Media Lists (see Section 2.3.15), a minimum of 100,000 transaction records, 2,000 summary records and 2,000 event/alarm records before a memory full condition is reached.

The main memory shall be backed-up with a physically separate, redundant memory module. The redundant memory module shall be a compact flash RAM with a capacity to accommodate all data stored in the main memory or a minimum of 8GB, whichever is greater. All PLP memory shall be non-volatile.

When the data storage capacity is exceeded, the PLP shall take itself out of service until the data can be successfully transferred and its memory cleared.

The ECU shall contain electronic clock functionality. The clock shall be used to generate time signals to maintain accurate records. The clock shall also contain calendar data to determine year, month, and day including leap year without manual intervention. Automatic correction for time changes between standard and daylight savings time shall be provided. The clock shall reset with the correct time each time communication is successful with the CDS. An attempt to reset and correct the time shall occur at least once per day.

Each transaction shall be recorded at the PLP and transmitted to the CDS immediately upon communication between the two. Each transaction shall be uniquely identified within the system.

Full detailed information on all transaction information stored by the PLP shall be provided as part of the data dictionary provided at the Preliminary Design Review and updated at the Final Design Review. **CDRL 14-4**

14.3.5 Transaction Records

The PLP shall store transaction records for each transaction performed at the PLP as well as for each alarm, event and remote action that occurs at the PLP.

To protect against missed and duplicate data, each record transferred to or from the PLP shall be serialized. Each time the PLP data is successfully transferred the last transaction number shall be transferred to the CDS, and the serialized transaction number shall be automatically reset. Each transaction record shall be unique within the NEPP System and shall be traceable to its source.

Transaction records shall be stored in the PLP and transferred to the CDS. PLP shall communicate status to the CDS upon request. The following events shall be detected and stored, as a minimum:

- All events and alarms sensed;
- All events and alarms cleared, including the identification of the user who cleared the alarm;
- All transaction data to provide a complete record of each transaction;
- 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 revenues and Smart Media.

Payment transaction records shall include the following data as a minimum:

- Serialized transaction number;
- Facility;
- Lane;
- Date;
- Time; and
- Fee paid.

Completed payment transaction records shall be transferred to the Parking Operations Office and displayed on an existing terminal. In addition, alarm and event transaction records which occur during a payment transaction shall also be forwarded to the Parking Operations Office and displayed on an existing terminal. These alarms and events shall include a description of the reason that the payment transaction could not be completed in addition to the above data items.

14.3.6 Diagnostics

The PLP shall be capable of detecting basic internal malfunctions. The malfunction detection shall cover all modules and shall include failure of power circuitry, control circuitry, opening of an access panel, interface failure, and any failure of the PPT that could result in a false, incomplete, or corrupted encoding of Smart Media.

Internal diagnostic programs shall check the PLP and its interfaces for proper performance each time it is turned on. When the performance of any parameter is not according to specification, the PLP shall create a transaction record and transmit it immediately to the CDS.

Any failure that occurs apart from the diagnostic check shall also be recorded and immediately transferred to the CDS. Out-of-service conditions shall be annunciated display. The information displayed shall indicate the type of failure that caused the PLP to shut down. All conditions sensed shall be reviewable and have priorities settable by WMATA with the text used for describing these conditions modifiable by WMATA. Method for changing this text and for setting priorities shall be provided.

14.3.7 Power Protection

PLPs shall be protected against potentially harmful power fluctuations and shall meet the requirements of Section 2.3.12.8.

14.3.8 Magnetic Credit Card Reader

The PLP shall be provided with the capability of accepting magnetic stripe-based credit cards as full parking payment. The bank card reader shall be a dedicated, commercially available “dip-insertion” type reader.

The bank card reader shall be able to read, translate, and transmit complete Track 1 and 2 data in accordance with ISO/IEC and ABA standards. Software for bankcard readers shall be in accordance with ANSI, ISO and ABA standards for data encryption.

If the magnetic stripe-based credit card processing is not activated for the PLP, then the swiping of any magnetic card in the reader shall have no effect. In addition, this shall have no impact on contactless credit card processing.

14.4 Fee Table

The NEPP Contractor shall provide software that permits WMATA to define, develop, edit and download the requisite parking fee tables, with a minimum of one fee table per facility with multiple fee sets provided for each fee table.

Each parking facility shall operate using a unique fee table stored in its equipment memory. This fee table shall incorporate a minimum of four (4) separate sets of fees. This shall provide for the present and three (3) future fee sets. Each fee set shall be assignable for activation and deactivation at specific dates/times or days of the week or both.

When a new facility is added to the system, a new fee table shall also be able to be generated specifically for that facility. In addition, multiple facilities shall be linkable to a single fee table.

Fee tables shall be able to cover the various parking facility needs and to cover special parking rates such as evenings, weekends, holidays, “early bird”, “night owl” and other similar events. The PLP shall accept new fee tables as uploaded from the Parking Operations Software.

14.5 Monitoring

Each PLP shall provide its status to the existing Parking Operations Center on a daily basis as well as all changes in status. This shall permit WMATA to monitor the health of the PLPs. These status changes shall be provided immediately to the CDS, which shall then transfer these immediately to the Parking Operations Center.

All messages identifying degraded status shall include the reason for the status degradation. These messages shall be transferred, upon occurrence, and displayed on a terminal located at the Parking Operations Center.

14.6 Operation during Power Failure

PLPs shall be able to operate during a power failure for a defined period of time as follows:

- For a facility where backup power exists for the entire facility, the PLP shall interface with the existing backup power system to operate for as long as that backup power lasts; and
- For a facility where no backup power exists, an Uninterruptible Power Supply (UPS) shall be provided for each location to ensure proper operation of the PLP and gate for a period not less than one (1) hour.

If communication with the CDS is maintained during such power failures, then communication shall continue between the PLP and the CDS.

14.7 Operation during Communication Failure

In cases of network failure, the PLP shall have sufficient capacity to store event and transaction data. This information shall be stored in both the PLP primary and redundant memories as needed to suit its operation. Upon successful re-connection of network operations, all stored transaction data (e.g., alarm, event, fee collection) shall be automatically transmitted to the CDS.

During periods of failure of communications between the PLP and the CDS, the PLP shall process the Smart Media presented, shall securely store this information and raise the parking gate to permit the Customer to proceed. When communications is restored, the PLP shall transfer all off-line transactions to the CDS where they shall be

authenticated and the proper fee charged/collected. (See "Orphan Mode Operation" as identified in Section 4.)

Should the fee be unable to be collected, the CDS shall add that Smart Media serial number to the Invalid Smart Media List to ensure that if presented, it will not be accepted.

14.8 Communications

Parking equipment shall communicate with the CDS (Section 16) via the NEPP Network (Section 15) to suit the needs of the parking system installation and operation. To support this, the parking system shall be configured, as a minimum with:

- Integral standard Ethernet Interface with RJ45 connector(s); and
- Wireless network interface, compliant with IEEE 802.11n Standard Protocols and IEEE 802.11i security provisions.

14.9 Structure and Finish

The parking equipment shall be constructed of revenue service proven materials. All displays shall be protected by polycarbonate or other revenue service proven materials, which do not inhibit operation. Where metals are exposed, these shall be stainless steel with a random orbital finish or other revenue service proven method.

All exterior surfaces shall be finished to permit easy removal of graffiti. Interior machine surfaces shall also be primed and painted or plated with corrosion-resistant material, unless they are stainless steel. Regardless of what materials are used, the types of material shall provide full protection against exterior and/or interior rusting.

The parking equipment shall be ergonomically designed, simple to use, and sufficiently robust to deter and withstand acts of vandalism and Customer abuse.

14.10 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 14-1	Complete description of PLP functionality	14.1	CDR, PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
CDRL 14-2	Complete description of the PLP physical characteristics	14.1	CDR, PDR	Yes
CDRL 14-3	Configuration and parameter settings	14.1	PDR, FDR	Yes
CDRL 14-4	Data Dictionary	14.4.4	PDR, FDR	Yes

End of Section 14

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15 COMMUNICATIONS

This section describes the communications infrastructure and interfaces that are necessary for the New Electronic Payments Program (NEPP). The communications system described in this section, the New Electronic Payments Program Communications Network (NEPPCN) shall transmit all data between the hardware associated with the NEPP. This includes communication between any two pieces of NEPP hardware as well as between any piece of NEPP hardware and a source internal or external to WMATA.

15.1 General Requirements

For the NEPPCN, all interfaces shall be designed to be both robust and secure. As required by Section 4, all communications network components and devices shall comply with the Payment Card Industry Data Security Standard (PCI DSS) and utilize End-to-End encryption. "End-to-end encryption" shall mean that the data shall be encrypted at the Payment Processing Terminal (see Section 3) through to the CDS and between the CDS and external financial payment networks.

All switches, Ethernet cards, device drivers and other networking components shall be IEEE 802.1p compatible.

All connections, other than individual NEPP device connections, shall incorporate redundant data paths to ensure reliable systems communications.

All communications interfaces shall, to the extent possible, automatically isolate and/or recover from failures and errors.

The NEPPCN shall also provide adequate bandwidth to each NEPP device such that there are acceptable levels of data throughput, as defined by WMATA.

All components of the NEPPCN shall be designed, configured, and installed in a non-proprietary manner.

All communications hardware shall meet the standards published in the latest release of WMATA's *Professionals' Guide to IT Standards and Services for Metro* at the time of system deployment and shall be capable of operations and successful integration into the WMATA environment. In addition, all hardware shall be service-proven and commercially available. No hardware shall be discontinued or shall have had its discontinuance or end-of-life announced.

The NEPP Contractor shall contract directly with all wireless communications providers needed to meet the NEPP requirements. Provisions within such a contract shall be incorporated to ensure that the wireless contract is assignable to WMATA at the conclusion of the Contract period, at the same compensation rates meeting the same requirements as provided to the NEPP Contractor.

This section also describes the communications cabling interface and demarcation requirements within WMATA's communications rooms. The interface to WMATA's existing communications infrastructure shall occur at the designated project demarcation points located inside these communications rooms. The subsystem cable type and interfaces required for each of the various equipment types are described within this Section.

The Contractor shall provide and install cabling and support equipment, including punch-down blocks, patch panels and other identified cable terminations between the fielded equipment located throughout each station facility and the local communications room. The demarcation type for each subsystem cable type shall be consistent at each facility and location.

The NEPPCN, including hardware and cabling, shall be designed to meet all financial transaction requirements outlined in all sections of the NEPP Technical Specification. Where the requirements of this section conflict with that of another section, the more stringent requirement shall be applicable.

Additionally, all requirements in this section shall be regarded as design minimums. The Contractor's design shall meet or exceed all requirements of this section, as necessary to support the transactional requirements outlined in all other sections of this Technical Specification and the Contract Documents. This includes responsibility for all leased services and for communications utilizing WMATA provided fiber optics.

No subsequent portion of this Section 15 shall be interpreted as superseding this requirement.

15.1.1 Network Configuration Plan

Within 30 days of NTP, the Contractor shall submit a Network Configuration Plan to WMATA for review and approval. **CDRL 15-1** The Contractor's Network Configuration Plan shall be sufficiently comprehensive to enable WMATA, with a high degree of confidence, to review the Contractor's intended approach for network architecture and design as well as to verify that the Contractor will meet the stated requirements, and to enable WMATA to monitor the contractual effort through all stages of NEPP implementation and warranty.

15.1.2 System Capacity and Availability

15.1.2.1 System Capacity

All NEPP communication network and sub-network elements (i.e. access points, switches, routers, and other System parts) shall provide sufficient bandwidth to support the specified transaction times for all devices, as outlined in Section 4, concurrently while in revenue operations, no less than 99.9% of the time. Conformance shall be determined for each individual LAN such as each Station LAN, Garage LAN, and sub-network elements as well as performance of the overall NEPP WAN.

Leased communications services, both wired and wireless, shall have the same capacity performance as Contractor supplied equipment, unless otherwise approved by WMATA.

The Contractor shall provide reports regarding system capacity and performance as requested by WMATA, but at a minimum on a monthly basis showing daily performance. WMATA shall also have the capability to poll all involved devices to ascertain response times, capacity and other performance measurements.

These capacity criteria shall apply to all scheduled and unscheduled network outages, regardless of whether the system is in Revenue Operations. No network maintenance activities shall be scheduled while the NEPP is in revenue operation. All scheduled network outages shall require prior written approval from WMATA.

Details regarding System capacity shall be submitted for WMATA's review and approval as part of the Network Configuration Plan. This information shall be provided for WMATA review at the Preliminary Design Review, and for approval at the Final Design Review. **CDRL 15-2**

15.1.2.2 System Availability

All NEPP communication network and sub-network elements (i.e. access points, switches, routers, and other System parts) shall be in service to support the specified transaction times of all devices, as outlined in Section 4, concurrently, no less than 99.99% of the time. Conformance shall be determined for each individual LAN such as each Station LAN, Garage LAN, and LAN elements such as switches, routers and access points, and other equipment, as well as performance of the overall NEPP WAN.

Leased wired communications services shall have the same availability performance as Contractor supplied equipment, unless otherwise approved by WMATA.

All leased wireless communications shall be available in at least 95% of the WMATA Service Area, at least 95% of the time measured on a daily basis, unless otherwise approved by WMATA.

These availability criteria shall apply to all scheduled and unscheduled network outages, regardless of whether the system is in Revenue Operations. No network maintenance activities shall be scheduled while the NEPP is in revenue operation. All scheduled network outages shall require prior written approval from WMATA.

Details regarding System Availability shall be submitted for WMATA's review and approval as part of the Network Configuration Plan. This information be provided for WMATA review at the Preliminary Design Review, and for approval at the Final Design Review. **CDRL 15-1**

15.1.3 Fiber-Optics

15.1.3.1 Multimode Fiber

The NEPP, where necessary, shall utilize multimode fiber optic cabling which, at a minimum, satisfy the standards, physical and transmission characteristics for Indoor/Outdoor Optical Fiber Backbone Cable specified in the latest edition of WMATA's *Department of Information Technology, Network and Communications Services Infrastructure Design and Wiring Standards*, at the time of Notice to Proceed. This includes fiber optic interconnect cables, including but not limited to jumpers (patch cords) and pigtails, used to connect the Distribution Frame Patch Panels with fiber optic modems. Connectors on each end of these interconnect cables shall be compatible with the equipment connectors to which they are to be attached. The Contractor shall properly install and terminate all fibers including spares with approved connectors in accordance with the aforementioned latest WMATA Design and Wiring Standards document at the time of System deployment.

All cables shall be cut to proper length before assembly. No wires/cables shall be doubled back to take up slack. Cables shall be properly secured to the fiber management system or fiber equipment. Cable slack shall be provided to facilitate the removal and replacement of assemblies, panels, and modules for maintenance.

The Contractor shall utilize Indoor/Outdoor Optical Fiber Non-Conductive Plenum (OFNP) Loose Tube with Laser Optimized 50/125 optical fibers. Each multimode fiber shall be compliant with the latest revision of ANSI/EIA/TIA-492AAAB.

The fiber in all cables shall be usable and meet the required specifications. Each optical fiber shall be sufficiently free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification. Each optical fiber shall be proof tested by the fiber manufacturer at a minimum of 100,000 psi.

The fiber within any given segment between two devices shall be splice free.

Each fiber shall meet or exceed the following physical characteristics:

A. Graded index multimode design with a nominal core diameter of 50 ± 2.5 micrometers (µm) and cladding diameter of 125 ± 3 µm;

B. Doped silica core and cladding with an acrylate coating diameter of 250 plus/minus 20 microns. The coating shall be in physical contact with the cladding surface;

C. Suitable for use in both outdoor and indoor applications without the use of a transition at the building entrance;

D. Suitable for use in risers, plenums and horizontal applications;

E. Suitable for underground and above ground conduits;

F. Have a dry water blocking system for cable core and buffer tubes;

G. Available with a fiber strand count range from 6 to 14;

H. Have a 3.0 mm sub-unit diameter;

I. Compliance with the requirements of ICEA S-83-596 “Standard for Fiber Optic Premises Distribution Cable” and ANSI/ICEA S-87-640 “Standard for Outside Plant Communications Cable;”

J. Strength members shall be dielectric and may be either fiber glass or aramid yarn;

K. Loose Tube fibers shall be color coded in accordance with EIA/TIA-598 “Fiber Optic Color Codes” with an overall blue jacket;

L. UV resistant.

Each fiber shall meet or exceed the following optical characteristics:

A. Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-78 and shall be less than 1 dB/km at 1300 nm;

B. Minimum dispersion bandwidth greater than 500 MHz-km at 1300 nm;

All fiber shall be flame retardant per the requirements of IEC 60332-3-24 and meet the low smoke requirements of UL 1685 and IEC 61034-2. In addition, all fiber shall be zero-halogen construction, per IEC 60754-2. All fiber shall have and shall be marked with a UL-OFNP and OFN FT6 Flame Rating.

In addition, all multimode fiber optic cable shall meet the following requirements of EIA/TIA-455-A, provisioned in EIA/TIA-568-B.3, Commercial Building Telecommunications Cabling Standard Part 3: Optical Fiber Cabling Components, April, 2002

A. Impact resistance of 25 impacts, maximum attenuation variation 0.2 dB;

B. Tensile strength 600 N (long term - operating), maximum attenuation variation 0.2 dB;

C. Low and high temperature bend, maximum attenuation variation 0.2 dB;

D. Compressive strength 220 N/cm;

E. Cable twist one 360 degree twist in 4 meters maximum attenuation variation 0.1 dB;

F. Cable freezing meets or exceeds EIA/TIA-455-A paragraph 98 test criteria;

G. Cable flexing 25 cycle (2-x O.D. bends), maximum attenuation variation 0.1 dB;

H. Bend radius static tests;

I. Meet or exceed EIA/TIA-455-A paragraph 104 at 20x O.D.;

J. Meet or exceed EIA/TIA-455-A paragraph 33 at 10x O.D.;

K. Cable aging test 120 hours at 85 degrees C;

L. 96 hours maximum attenuation of 0.2 dB/km;

M. 120 hours maximum attenuation of 0.4 dB/km.

The Contractor shall provide interconnect cables (including jumpers and pigtails) in sufficient quantities and lengths to complete all required optical circuits. The performance characteristics of the breakout cable shall be certified to meet or exceed that of the distribution cable. Cable shall be specifically designed by the manufacturer for optical connector attachment. Each fiber shall be contained in a breakout jacket compatible with optical connectors specified elsewhere.

Fiber Optic cable installed in indoor areas (platform, mezzanine, basement, etc.) shall be tight-buffered fiber. Fiber Optic cable installed outdoors or partially outdoors shall be loose buffered fiber. The fiber optic cable from the station communication rooms to all equipment shall be breakout cable, and have a manufacturer specified installation pulling tension of 540 pounds (2400 N) minimum. The cable shall be rated OFNP per NEC Article 770.

Environmental

Cables shall operate over a temperature range of -40°C to +75°C at a relative humidity of 10% to 99% condensing.

Installation

Installation of fiber optic cable shall be in accordance with all manufacturers' criteria and the Backbone Cable Installation requirements specified in latest edition of WMATA's *Department of Information Technology, Network and Communications Services Infrastructure Design and Wiring Standards*, at the time of System deployment. In addition, all fiber optic cables shall meet the following criteria:

- The long term installed maximum tensile loading shall be 200 pounds or less;
- The bend radius shall not exceed the manufacturer's published specifications;
- Cable pulls shall be made by back-feeding or center-feeding cable;
- The manufacturer's recommended allowable tension load shall not be exceeded. If a winch is used, the tension of cable shall be monitored with a tensiometer during installation. There shall be no tension on the cable, excluding that due to cable weight, following installation.

Certification

Certification shall include the following information for each segment of cable:

A. Loss profile for multimode (850 nm and 1300 nm) fiber shall be determined with an OTDR or equivalent instrumentation. All reels of cable shall be tested before and after installation. The test results shall be provided to WMATA.

B. Verification that each segment supports the required bandwidth.

Terminations

A. All fiber connector terminations shall be made with a SC connector, and meet all requirements outlined in Section 15.1.3.3 and the Optical Fiber Termination Hardware requirements specified in latest edition of WMATA's *Department of Information Technology, Network and Communications Services Infrastructure Design and Wiring Standards*, at the time of System deployment;

B. Fiber splices shall be low-loss mechanical type. Splice joint and protection covering shall have the pull strength of the original cable or fiber;

C. Fiber terminations at each field interface box shall be of the mechanical type with polished ends on both the connector and the fiber strand;

D. Cable terminations and splice losses shall be recorded for maintenance purposes and provided to WMATA; and

E. No mechanical crimp connections shall be allowed.

Splices

A. Fiber optic splices shall be fusion splices and shall be provided with protection, depending on the application, indoor/outdoor.

B. Indoor (station) splices shall be placed in a splice tray or organizer. Combination splice tray and termination panel is an acceptable alternative. Protection for splices shall be per manufacturer's instructions.

C. Fusion splices shall achieve an optical loss of less than 0.3 dB at 1310 nm. The amount of splice loss shall be stable over time and unaffected by changes in environmental or mechanical conditions.

Identification

Cables shall be labeled in accordance with Section 2.

Testing

After installation, the fiber optic cable shall be performance tested.

The Contractor shall provide the fiber optic cable test as defined in ANSI/TIA/EIA-568-A, ANSI/TIA/EIA-568-B.1, ANSI/TIA/EIA-526-14, ANSI/TIA/EIA-526-7. Testing shall assure overall integrity and satisfactory performance of all installed cables.

The Contractor shall perform the following tests on all fiber optic cable strands:

A. Insertion loss using a relative test.

B. Optical Time Domain Reflectometer (OTDR) tests shall be performed, end-to-end, in both directions and the loss profile of the cable, plus splices and connectors shall be recorded for future reference. Both pre-and post-launch test fibers shall be used at each end of the fiber optic cable during testing so that accurate loss measurements can be made for the near and far end connectors. The Contractor shall record the test results in both hard copy format (printouts) and in an electronic file format. The Contractor shall propose the electronic file format that is to be utilized for WMATA's review and approval. **CDRL 15-3**

C. Each local fiber shall be OTDR tested between the patch panels, through the local connectors to the end of the drop cable at the field device. Additionally, each local distribution fiber shall be OTDR tested from the end of the drop cable at the field device, through the local connectors to the patch panel.

Contractor shall provide all information on fiber optic cabling that is to be installed for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-4**

15.1.3.2 Distribution Shelves

Fiber optic distribution shelves (FODS) shall be provided for the termination and optical continuation of fiber optic cables with panel mounted bulkhead connectors in dedicated groupings called connector fields.

Connector fields shall contain 12 connectors per row, with enough bulkhead connectors to terminate every fiber of every cable at each station. The connector fields shall be identified by function, spare and cable number. All fibers in the communication room shall terminate in the fiber optic distribution shelf (FO Patch Panel).

The FODS shall be EIA-310-C standard 19-inch rack mounting and consist of a compartment for termination/distribution cable tray and a compartment for a splice drawer. Each fiber optic distribution shelf shall be provided cable clamps sufficient in quantity and strength to secure fiber cables terminating in the FODS.

The FODS shall include sufficient bulkhead adapters for all fibers and sufficient corresponding optical fiber pigtail/jumper assemblies with the appropriate factory connectors to mate with the bulkhead adapters as shown on the Contract Drawings.

The termination/distribution shelves shall have sufficient tray areas for excess fiber storage with provisions to assure that optical fibers do not violate the recommended minimum bend radius.

The bulkhead panel shall include a designation strip for identification of the bulkhead connectors and connector fields.

In addition, all FODS/LIU (Lightguide Interconnect Unit) will be in accordance with WMATA's IT/NCS Approved Materials List, Appendix B.

Contractor shall provide all information on all distribution shelves that are to be installed for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-5**

15.1.3.3 Network Components

Fiber Optic Connectors

Contractor shall provide optical fiber connectors on equipment and interconnecting optical cables. All connectors when mated shall be capable of withstanding a 10-pound pullout force applied to the cable with less than 0.1 dB optical degradation to the optical connection. All connectors when mated horizontally shall be capable of withstanding a 10-pound weight applied to the cable with less than 0.1 dB optical degradation to the optical connection. Connectors for cable ends shall consist of a stainless steel outer shell and ceramic fiber guide way. Connectors shall be capable of achieving less than 0.3 dB attenuation when installed per connector manufacturer's installation recommendations.

All connectors shall be of a design specifically matched to the optical fiber specified elsewhere. Fiber connector terminations shall be made with a SC style connector, which shall accept a nominal fiber diameter of 125 micrometers (µm). The SC style connector shall exhibit insertion losses of not more than 0.3 dB at 1300 nm for multimode fiber. All SC-type connectors shall be stable over an operating range of -40 to +75 degrees Celsius. All mechanical terminations shall have polished ends.

Biconic and SMA derivative connectors shall not be supplied.

All optical connectors on the fiber cables shall be cleaned in compliance with optical connector manufacturer's specifications and covered with dust caps until connected to the fiber optic equipment/modules.

Contractor shall provide details regarding all types of Fiber Optic Connectors that are to be installed for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-6**

15.1.3.4 Transmission Equipment

All transmission equipment shall be capable of transmitting data over a single multimode fiber or a pair of multimode fibers. The fiber optic modems shall be standalone units with matching pairs. All modems shall be furnished from the same manufacturer.

All remote and equipment hub transceivers shall satisfy the following requirements:

- Data Format: 100Base-T Fast Ethernet
- Channels: 1 Duplex
- Baud Rate: Compliant with IEEE 802.3
- Bit Error Rate: <1.0E-10
- Optical Mode: Multimode
- Optical Budget: 13 dB
- Optical wavelength: 850 nm and/or 1300 nm
- Transmitter Launch Power: >-10 dBm

- Receiver Sensitivity: <-33 dBm
- Gain Control: Optical Automatic Gain Control (OAGC)
- Electrical Input Power: 13.5 VDC regulated
- Current Requirement: 300 mA
- Power Consumption: 0.2 W
- Power Factor: 3
- Protection: Solid-state short circuit protection

Environmental Operating

- Temperature range: -40° C to + 75° C
- Maximum Humidity: 95% relative, non-condensing
- Standards Emissions: FCC Part 15, ICES-003, AS/NZS 3548, EN55022
- Safety: UL 1950, CAN/CSA 22.2 NO. 950 95, EN60825
- Mechanical: Standalone Unit or Rack Mount

Contractor shall provide all information on all transmission equipment that is be installed for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-7**

15.1.3.5 Interconnect Hardware

Installation shall include all required interface cable types as specified in this Section. All modules in the communications system shall be replaceable without requiring that the power supply be turned off and without disturbing the operation of any other modules in the same rack frame and power supply assembly. All modules shall be labeled on the front panel to identify the fiber passing through the module.

15.1.3.6 Distribution Frame

The Contractor shall install sufficient quantity of Fiber Optic Distribution Shelves to terminate all of the fibers within the location equipment rooms. The Distribution Shelves shall be installed in the communication room cabinets. At each distribution panel, the Contractor shall terminate the fibers associated with the specific fiber optic group from each field device assembly to the optical bulkhead adapters.

The Contractor shall terminate the fibers that are designated as spare to the optical bulkhead adapters. The fibers shall be of appropriate lengths to allow for future splicing within the distribution frame and shall be appropriately identified (tagged). Appropriate protective coating shall be applied to all splices.

Each fiber optic modem pair shall have four (4) multimode fibers home run from an interface box to the communications/equipment room. There shall be ten (10) feet of slack cable coiled at both termination points. The interface box shall be sized appropriately and the fiber coiled in such a manner not to exceed the recommended minimum bend radius. All fibers, including spares, shall have the ends polished and terminated with SC style low-loss mechanical terminations. All fibers shall be labeled and tested according to industry standards. Connectors and cables shall be protected from the environment, and provide an acceptable means of protection from vandalism.

The fiber optic distribution cables from the communications rooms to the field devices shall be fitted with SC style connectors. At the communication room interface, each fiber optic cable shall be terminated at a fiber optic distribution shelf. Fiber optic patch cords shall be used for device interconnections.

15.1.4 Wireless Communication Systems

The New Electronic Payments Program Wireless Communication (NEPPWC) system shall transfer data on mobile, handheld, station, and parking devices utilized throughout the NEPP. All wireless communications shall be state of the art utilizing the latest commercially acceptable industry standards. The NEPPWC shall include expandability and upgradability to the latest technology with minimum hardware and software changes.

A complete description of all NEPPWC elements shall be provided with the Network Management Plan for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality as required within this section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 15-8**

15.1.4.1 Wireless Broadband Communications

Primary communication for Regional Partner vehicles shall be via wireless broadband communication. Primary communication for WMATA vehicles shall be using the method identified in Section 10.

The NEPP shall accept Smart Media as fare payment in the mobile environment, as outlined in Sections 3 and 4. This includes acceptance by the OBPTs, HSDs, PVs, Faregates/Turnstiles, parking devices, CSTs, and FVDs, and may also include any other piece of NEPP field equipment. To support the required transaction processing times, as required by Section 3, on the NEPP mobile devices, the Contractor shall utilize a commercially available wireless broadband communications system for transmission of the transactional data to inter-bank or non-bank financial clearing systems for transaction authorization and settlement purposes.

The NEPP Commercial Wireless Broadband Communications system shall be established through a third-party wireless communications vendor and shall be verified by the Contractor. The NEPP Commercial Wireless Broadband Communications system shall utilize a recognized 4G technology, either the Worldwide Interoperability for Microwave Access (WiMax) which is based on IEEE 802.16 or the 3rd Generation Partnership Project (3GPP)'s Long Term Evolution (LTE) systems, or WMATA approved current standard technology. The NEPP Commercial Wireless Broadband Communications system shall not utilize any citywide public access wireless broadband communications network.

The Commercial Wireless Broadband Communications system utilized by the NEPPCN shall:

A. Meet the requirements of Section 15.1.2 in providing communication between mobile NEPP devices and the CDS;

B. Be an All IP Network (AIPN) utilizing the TCP/IP protocols;

C. Seamlessly support the transition of NEPP devices to available 3G and then to 2G based on network availability and outages;

The use of a 3G system that does not support the enhanced throughput of a 4G technology without a hardware upgrade is prohibited.

15.1.4.2 Possession of Commercial Wireless Broadband Service

For the duration of the NEPP and up to the conclusion of the overall NEPP Warranty period, the Contractor shall provide, support and maintain control of the Commercial Wireless Broadband system. At no time during this period, shall WMATA be required to interact directly with the wireless provider.

Any agreement between the Contractor and the wireless provider shall not affect nor supersede or reduce in any way the responsibilities of the Contractor to WMATA.

During the closeout of this project, the Contractor shall transition the control of all commercial wireless service to WMATA.

A complete description all Commercial Wireless Broadband communications shall be provided for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality as required within this Section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 15-9**

15.1.4.3 Local Wireless Communications

NEPP Local Wireless Communications shall be defined as all limited area networking coverage used throughout the NEPP. This method of communication shall be based on the IEEE 802.11n standard (or WMATA-approved equal) for wireless networking.

To achieve maximum throughput the IEEE 802.11n network, the NEPP Local Wireless Communications shall operate in the 5 GHz band. To ensure system integrity and security, access points shall not be backwards compatible with previous IEEE 802.11 standards.

The operation of the 802.11n communications in the 2.4 GHz band is strictly prohibited.

For all occasions where the Contractor deploys IEEE 802.11n compliant hardware, it shall make full use of both Multiple-Input Multiple-Output (MIMO) and Channel-bonding (40 MHz) operation to the physical layer, as well as frame aggregation to the MAC layer. With MIMO, all IEEE 802.11n compliant hardware shall support Spatial Division Multiplexing (SDM).

It is intended that the use of IEEE 802.11n compliant networking, combined with wider bandwidth and MIMO technology, shall maximize the data transfer rates available to the NEPPCN.

Wireless Access Points

To support the NEPPCN, all wireless access points shall operate exclusively in 802.11n, 5 GHz, frequency band. The Contractor shall ensure that all wireless access points satisfy, at a minimum, the performance requirements and standards of the preferred wireless access points identified in the latest edition of the WMATA publication *Professionals' Guide to Information Technology Standards and Services for Metro*, at the time of System deployment.

Contractor shall provide all information on all wireless access points that are to be installed for WMATA review at the Conceptual Design Review and for approval at the Final Design Review. **CDRL 15-10**

All wireless access points shall be manufactured by Cisco (or WMATA-approved equal) and be suitably designed and manufactured to tolerate rugged use in the outdoor transit environment. These access points shall:

A. Be Certified IEEE 802.11n Compliant, or approved equal;

B. Support Multiple-Input Multiple-Output (MIMO) technology;

C. Support Maximal Ratio Combining (MRC);

D. Support 20-and 40-MHz channels;

E. Support PHY data rates up to 300 Mbps;

F. Incorporate antennas to support 5.0 GHz transmissions.

Any wireless access points that support 802.11n communications in the 2.4 GHz band shall have this functionality specifically disabled within the firmware of the device.

Encryption

All local wireless communications shall be compliant with IEEE 802.11i and support non-proprietary methods for encryption of data. This encryption shall employ no less than 128-bit data encryption with WPA/WPA2-TKIP/AES.

The Contractor shall develop the methods to automatically and programmatically assign or update any digital encryption certificates used by the system. The use of manual delivery methods and permanent Pre-Shared Keys (PSK) encryption keys is not acceptable.

15.1.5 Leased Lines

The Contractor shall establish leased lines to provide network connectivity at WMATA locations that do not yet have Fiber Optic cabling installed.

All leased lines shall meet the minimum requirement of T1, providing a minimum guaranteed transfer rate of 1.544 Megabits per second. Leased lines may take advantage of a Frame Relay protocol.

All leased lines shall meet the requirements of Section 15.1.2.

A complete description all leased lines shall be provided for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality as required within this section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 15-11**

Prior to final completion of this project, the Contractor shall be responsible to WMATA for the successful operation of these leased lines. At no time during this period, shall WMATA be required to interact with the leased line provider.

Any agreement between the Contractor and the provider of the leased line shall not affect nor supersede the responsibilities of the Contractor to WMATA.

During the closeout of this project, the Contractor shall transition the control of all leased lines to WMATA.

15.1.6 Miscellaneous Equipment

The Contractor shall provide all miscellaneous equipment not expressly stated in this Section, but required by the Contractor's design. The use of media converters shall be kept to a minimum. Contractor shall provide all information on any miscellaneous equipment that is to be installed for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-12**

15.1.7 Enclosures

All NEPP communications equipment shall be installed in NEMA rated cabinets and enclosures. All cabinets shall be NEMA 4X rated, unpainted stainless steel with full-hinged doors.

Equipment housing and its components shall be corrosion resistant. All seams shall be continuously welded and ground smooth, with no holes or knockouts. Boxes shall include seamless foam-in-place gaskets to provide watertight and dust-tight seals.

Each enclosure/cabinet shall be provided with a nameplate on its front. Nameplate nomenclature shall be according to a schedule approved by WMATA. Nameplates shall be of a black laminated plastic material with letters engraved on the plate in white. Secure nameplates on equipment with stainless steel screws.

Enclosures/cabinets shall be delivered to the construction site complete. All electrical devices shall be in place and wired. If any electrical devices or accessories must be shipped loose, they shall be delivered in the manufacturer's original unopened packaging.

Cabinets shall be provided with required accessories to mount internal electronic components, including but not limited to, DIN Rails and brackets, mounting panels, grounding kits, and lockable hardware with locks keyed to WMATA's standard Cat 30 keys.

Enclosures/cabinets shall include rack mount-type power strips with sufficient outlets to connect all equipment and have at least two spare outlets remaining.

Enclosures/cabinets shall be sized with sufficient air space within the cabinet to accommodate wiring, allow for convenient equipment maintenance, and permit adequate heat dissipation for installed equipment. All enclosures shall be sized to accommodate the required equipment assemblies of the selected hardware to be enclosed.

Contractor shall provide all information on all enclosures that are to be installed for WMATA review at the Conceptual Design Review and for approval at the Final Design Review. **CDRL 15-13**

15.2 NEPP Communications Networks

The Contractor shall design, install, and test the NEPP Communications Networks (NEPPCN). These networks shall provide the secure transmission of all data related to the NEPP, between the Central Data System (CDS) and all of the NEPP components. This network shall utilize hardware that meets the requirements of Section 15.1.

The NEPPCN shall leverage the existing MetroNet communications network to communicate with fixed location field devices where feasible. This shall include all equipment installed at Metrorail mezzanines as well as all bus and parking facilities.

The Contractor shall select the communications protocol utilized within the NEPPCN. This protocol shall be secure, non-proprietary, based on an industry standard, and shall operate reliably. This protocol shall be selected based on the physical configuration of the system and WMATA's need for highly secure and reliable communications to satisfy operations and reliability requirements. Details regarding the selected network protocol shall be included in the Network Management Plan and submitted for the review and approval by WMATA at the Preliminary Design Review. **CDRL 15-14**

All communications hardware shall be capable of operations and successful integration into the WMATA environment. In addition, all data communications hardware shall be service proven and commercially available. This hardware shall meet the requirements of Section 15.1 and shall be, together with all certifications, submitted to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-15**

15.2.1 Network Addressing

MetroNet shall provide IP network addressing for all devices on the NEPPCN. If the Contractor determines that MetroNet's Network Addressing is insufficient or deficient for any reason, the Contractor shall develop an IP addressing plan for all devices on the NEPPCN. The Contractor shall submit this plan to WMATA for review and approval. The use of unallocated addresses or IP addresses assigned to others shall not be permitted.

Any such details regarding Network Addressing shall be included in the Network Management Plan and submitted for WMATA review at the Preliminary Design Review and finalized at the Final Design Review. **CDRL 15-16**

15.2.2 WMATA MetroNet Communications Network

The MetroNet Communications Network (MetroNet) is based on a hierarchical design of Core, Distribution and Access. MetroNet utilizes four Cisco high performance routers in a redundant core configuration. These four Cores serve 10 Gigabit link interconnections between seven Metrorail Station Distribution nodes. Nodes are equipped with redundant 10 Gigabit fiber optic paths connected to one of the core routers at both JGB and WMATA's business recovery site, the Carmen Turner Facility (CTF). Metrorail stations are connected to each other along the line and many also connect to the distribution stations. These Metrorail stations are connected by a collapsed ring topology where each station has at least two physical 1 Gigabit Ethernet connections to its next hop neighbors. Each ring segment has three physical paths back to the Core. MetroNet also hosts twenty locations that are detached from MetroNet's fiber optic network. These locations are connected via Verizon's 10 Megabit TLS (Transparent LAN Service) to JGB and CTF. These twenty locations represent the Off-ROW locations.

The NEPPCN shall leverage the existing MetroNet to communicate with fixed location field devices where feasible. This shall include all NEPP equipment installed at Metrorail mezzanines as well as all bus and parking facilities.

For locations where the use of the existing MetroNet is proposed, the Contractor shall be required to test and verify its suitability. If the Contractor determines that the WMATA infrastructure insufficient or deficient for any reason, the Contractor shall notify WMATA and propose corrective action(s).

At all locations, the Contractor shall connect all NEPP equipment with the appropriate segment of MetroNet.

The NEPPCN shall utilize the MetroNet communications network to provide secure transmission of all data related to NEPP equipment in the system. It is intended that through this network, FVDs, Faregates, and all other NEPP equipment shall have real time communications with the CDS.

Details regarding the NEPPCN design within and external to the MetroNet infrastructure, including architecture, physical arrangement, and all necessary hardware shall be provided with the Network Management Plan and shall be submitted for WMATA review at the Preliminary Design Review and finalized at the Final Design Review. **CDRL 15-17** The Contractor shall submit the NEPPCN design within and external to the MetroNet infrastructure, including installation and equipment details, for WMATA's review and approval prior to the commencement of any installation effort.

15.2.3 Metro Station and Facilities Local Area Networks

At all Metrorail Stations, Bus, LRV/Trolley and Parking facilities, the Contractor shall utilize the MetroNet station or facility LAN to support the installation of NEPP equipment where feasible. The LAN shall serve to connect all NEPP equipment at a station to the MetroNet WAN.

As part of the MetroNet LAN, the Contractor shall not install any additional network hardware at any station booth or secondary cabinet. Should the Contractor need additional network hardware, including modems and/or hubs, this hardware shall be installed within the FVDs, faregates, or other NEPP devices. For FVDs and faregates, network hardware shall be installed in one device per logical grouping. NEPP devices containing network equipment shall be designated as Primary or "A" equipment. All other devices shall be designated as Secondary or "B" equipment.

The Contractor shall connect all NEPP equipment to the station or facility LAN. All connections shall be made via either CAT 6 Ethernet cable or multimode fiber optic cable as necessary due to cable length. Supplied cabling and networking hardware shall be sufficient to support simultaneous communications of all NEPP devices at the station or facility.

The use of existing MetroNet communications connections at each station or facility shall not be exempt from the requirements for PCI-DSS compliance. The Contractor shall make any modifications necessary to these communication connections, including the securing of connections at either end, as necessary to fulfill all requirements of PCI-DSS.

The design and installation, including document and drawings, of each station and facility LAN, including architecture, physical arrangement, equipment configurations and details of all necessary hardware shall be submitted, in station and facility specific packages, and shall be subject to WMATA review and approval. **CDRL 15-18** The Contractor shall submit the final design for the installation of equipment within the station LAN, in station and facility specific packages, for WMATA's review and approval prior to the commencement of any installation effort. **CDRL 15-19**

15.3 Wireless Communication Applications

Wireless communications shall be utilized extensively throughout the NEPP to support network communications to mobile NEPP devices. The NEPP Wireless Communication (NEPPWC) system shall transfer data on mobile, handheld, station, and parking devices utilized throughout the System.

The Contractor shall develop the NEPPWC systems outlined below. These systems shall meet the requirements of Sections 15.1.2 and 15.1.4.

The Contractor shall submit the design for all NEPP wireless communications applications, installations and implementations for WMATA's review at each of the Design Reviews and approval prior to the commencement of any installation effort. **CDRL 15-20**

15.3.1 Wireless Broadband Communications

The NEPP shall accept Smart Media as fare payment in the mobile environment, as outlined in Sections 3 and 4. This includes acceptance by the OBPTs, HSDs, PVs, Faregates/Turnstiles, parking devices, and FVDs, and may also include any other piece of NEPP field equipment. To support the required transaction processing times, as required by Section 3, on the NEPP mobile devices, the Contractor shall utilize a commercially available wireless broadband communications system that shall meet all the requirements of Section 15.1.4.1.

Details regarding the use of wireless broadband communications, including architecture, physical arrangement, and all necessary hardware shall be submitted in addition to the Network Management Plan for WMATA review at the Preliminary Design Review, and finalized at the Final Design Review. **CDRL 15-21**

15.3.2 Fixed Location Devices

At some WMATA Metrorail stations, parking facilities, and within the street car environment, fixed location devices such as FVDs, PVs, and all street car equipment will not be connected to a wired network. These NEPP devices will require communications with the CDS. To support the deployment of these devices as well as equipment installed in remote locations on other modes of operation, a Wireless LAN shall be established at these locations (see Section 15.3.2). This Wireless LAN shall be connected to a wireless broadband modem for communications with the CDS.

The cellular modems will not always be installed indoors or in a sheltered location. These cellular modems shall be robust and secure, and shall be designed to operate in an environment that is exposed both to the elements and the general public.

The Wireless Broadband communications for fixed location devices shall meet the requirements of Section 15.1 and shall be, together with all certifications, submitted to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-22** Site specific details regarding the configuration, placement, and installation of communications hardware shall be submitted to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-23**

15.3.3 Local Wireless Communications

Local Wireless Communications shall be utilized at bus facilities and LRV/trolley barns throughout the WMATA NEPP. All Local Wireless Communications shall at a minimum, comply with the requirements of Section 15.1.4.3.

Details regarding the use of Local Wireless Communications, including architecture, physical arrangement, and all necessary hardware shall be submitted in addition to the Network Management Plan for WMATA review at the Preliminary Design Review and finalized at the Final Design Review. **CDRL 15-24**

15.3.3.1 On-Board Bus Payment Target Communications

The NEPP shall communicate wirelessly with the OBPT. This wireless communication shall be provided at all bus facilities as part of the NEPPWC. This communication shall be established using the IEEE 802.11n standard, as required for all Local Wireless Communications in Section 15.1.4.1.

All vehicles shall upload and download data at startup, when entering the garage, while at the Revenue Islands, and at any time that a manual request for data is initiated from the OBPT. This requires that the NEPP local wireless communications network be able to communicate at all times with the OBPT located anywhere within the bus facility.

To support this, an IEEE 802.11n Wireless Access Point (WAP) shall be provided at each Revenue Island and as necessary throughout the garage facility to provide coverage to all OBPTs throughout all bus parking areas.

All communications shall meet the requirements of Section 15.1 and shall be, together with all certifications, submitted to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-25** Site-specific details regarding the configuration, placement, and installation of communications hardware shall be submitted to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-26**

15.3.3.2 Fixed Location Device Communications

The NEPP shall communicate wirelessly with fixed location devices such as FVDs and PVs. This wireless communication shall be provided at certain WMATA Metrorail stations, parking facilities, and within the street car environment. This communication shall utilize the IEEE 802.11n standard, as required for all Local Wireless Communications in Section 15.1.4.1.

To support this, an IEEE 802.11n Wireless Access Point (WAP) shall be provided at each station where the NEPP fixed location devices are required. This WAP will serve to establish a Wireless LAN that connects the NEPP devices with the Wireless Broadband connection, as outlined in Section 15.1.4.1.

The WAPs will not always be installed indoors or in a sheltered location. These WAPs shall be robust and secure, and shall be designed to operate in an environment that is exposed both to the elements and the general public.

All communications shall meet the requirements of Section 15.1 and shall be, together with all certifications, submitted to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-27** Site-specific details regarding the configuration, placement, and installation of communications hardware shall be submitted to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 15-28**

15.4 Business Recovery Site

For data redundancy and disaster recovery, two identical instances of the CDS shall be constructed and maintained, a primary CDS and a Disaster Recovery (secondary) CDS (see Section 16). The above outlined communications networks shall be linked to the primary CDS located within WMATA's IT Data Center at Jackson Graham Building and to the Disaster Recovery (secondary) CDS, located at WMATA's business recovery site, the Carmen Turner Facility (CTF) Data Recovery Site.

The primary CDS shall be in constant communication with the Disaster Recovery CDS via a fiber optics communications link. Through this link, each CDS shall be maintained as a mirror image of the other. The Contractor shall establish this communications link between WMATA's IT Data Center and business recovery site, CTF, via WMATA's existing MetroNet communications network. If the existing MetroNet communications network is insufficient or deficient for this purpose, the Contractor shall notify WMATA and propose corrective action(s).

In the event that the primary CDS is forced offline for any reason, the Disaster Recovery (secondary) CDS shall be capable of operating all of the NEPP. As such, all hardware provided for this link shall be sized such that the requirements of Section 16 are still satisfied when the Disaster Recovery system is operating in place of the production CDS.

Full information for all communications hardware and software for WMATA's business recovery site, CTF, shall be subject to WMATA review and approval. **CDRL 15-29**

15.5 External Communication Interfaces

15.5.1 Financial Transaction Processing

The NEPP shall provide customers with the ability to use valid contactless credit and debit media for payment of fares. WMATA intends to have the CDS manage these financial transactions.

To accomplish this, the NEPP shall have a communication link with one or more financial institutions (banks and/or clearinghouses) for the purposes of processing financial transactions. These transactions shall include obtaining authorization to complete a transaction with a credit card or debit card and reconciliation of all completed and reversed credit and debit card transactions. These transactions shall also include collecting payment for automatically loaded (replenished) value to a Smart Media Transit Account from a linked checking or savings account.

A secure communications path (including all software) with necessary redundancy that satisfies all standards and operational requirements (ISO/IES 8285, ABA, PCI) shall be provided between the CDS and all financial institutions using end-to-end encryption methodology. This connection shall use the existing MetroNet infrastructure to the greatest extent possible. The Contractor shall test and verify the suitability of the existing MetroNet infrastructure to achieve the above requirements for a secure communications path. If the Contractor finds the WMATA infrastructure insufficient or deficient for any reason in achieving those requirements, the Contractor shall notify WMATA and propose a suitable solution to provide a dedicated high-speed and secure connection capable of supporting at a minimum, a Digital Signal 3 (DS3) level of service.

15.5.2 Payment Card Industry

The NEPP shall accept valid credit and debit media as a form of payment. Because of the sensitive nature of credit/debit card transaction data, all NEPP devices that read credit or debit cards, and all communications and computer systems comprising the fare collection system, shall be in full compliance with the latest versions of the Payment Card Industry's Data Security Standard.

PCI Compliance is discussed fully in Section 4. Special attention shall be paid to complying with the physical security requirements of PCI DSS during the installation process, especially the following:

- Physical access to routers, network hubs, wireless access points / gateways shall be restricted.
- There shall be no publicly accessible network jacks for the NEPP.

Contractor shall provide descriptions of how physical security compliance has been attained for PCI DSS. **CDRL 15-30** For all wireless communications, PCI DSS requirements and testing procedures for wireless environments apply and are mandatory. Supporting documentation to certify that the system meets the PCI DSS requirements shall be subject to WMATA review and approval not less than sixty (60) days prior to commencement of installation of the NEPP equipment. **CDRL 15-31**

15.6 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 15-1	Provide Network Configuration Plan detailing the Contractor's intended approach for network architecture and design, inclusive of details regarding System Capacity and System Availability.	15.1.1	CDR, PDR, FDR	Yes
CDRL 15-2	Provide the electronic file format to be utilized for fiber Optic cable Optical Time Domain Reflectometer (OTDR) tests performed.	15.1.3.1	PDR	Yes
CDRL 15-3	Provide all information and technical specifications on fiber optic cabling to be installed.	15.1.3.1	PDR, FDR	Yes
CDRL 15-4	Provide all information and technical specifications on all distribution shelves to be installed.	15.1.3.2	PDR, FDR	Yes
CDRL 15-5	Provide details regarding all types of Fiber Optic Connectors to be installed.	15.1.3.3	PDR, FDR	Yes
CDRL 15-6	Provide all information on all transmission equipment be installed.	15.1.3.4	PDR, FDR	Yes
CDRL 15-7	Provide a complete description of all NEPPWC elements in conjunction with the Network Management Plan.	15.1.4	CDR, PDR, FDR	Yes
CDRL 15-8	Provide a complete description all Commercial Wireless Broadband communications to be provided. Provide sufficient detail to permit verification that all required functions are satisfactorily	15.1.4.2	CDR, PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
	included.			
CDRL 15-9	Provide all information and technical specifications on all wireless access points to be installed.	15.1.4.3	CDR, FDR	Yes
CDRL 15-10	Provide a complete description of all leased lines. Provide sufficient detail to permit verification that all required functions are satisfactorily included.	15.1.5	CDR, PDR, FDR	Yes
CDRL 15-11	Provide all information and technical specifications on any miscellaneous equipment to be installed.	15.1.6	CDR, FDR	Yes
CDRL 15-12	Provide all information and technical specifications on all enclosures to be installed.	15.1.7	CDR, FDR	Yes
CDRL 15-13	Provide details regarding the selected network communications protocol utilized within the NEPPCN.	15.2	PDR	Yes
CDRL 15-14	Provide details, information, technical specifications, and certifications for all communications hardware to be used within the NEPP and integrated into the WMATA environment.	15.2	PDR, FDR	Yes
CDRL 15-15	Provide details regarding Network Addressing Plan for all devices on the NEPPCN to supplement MetroNet's IP network addressing scheme as necessary.	15.2.1	PDR, FDR	Yes
CDRL 15-16	Provide the NEPPCN design within and external to the MetroNet infrastructure, including installation and equipment details.	15.2.2	PDR, FDR	Yes
CDRL 15-17	Provide the design and installation plan, including document and drawings, of each station and facility LAN, including architecture, physical arrangement, and details of all necessary hardware.	15.2.2.1	CDR, PDR	Yes
CDRL 15-18	Provide the final design for the installation of equipment within the station LAN, in station and facility specific packages.	15.2.2.1	FDR	Yes
CDRL 15-19	Provide the design for all NEPP wireless communications applications, installations and implementations.	15.3	CDR, PDR, FDR	Yes
CDRL 15-20	Provide details regarding the use of wireless broadband communications, including architecture, physical arrangement, and all necessary hardware	15.3.1	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
CDRL 15-21	Provide details and certifications for the Wireless Broadband Communications system for fixed location devices.	15.3.1.1	PDR, FDR	Yes
CDRL 15-22	Provide site specific details regarding the configuration, placement, and installation of communications hardware.	15.3.1.1	PDR, FDR	Yes
CDRL 15-23	Provide details regarding the use of Local Wireless Communications, including architecture, physical arrangement, and all necessary hardware.	15.3.1.1	PDR, FDR	Yes
CDRL 15-24	Provide details and certifications for the Wireless Broadband Communications system for the On-Board Processor.	15.3.2.1	PDR, FDR	Yes
CDRL 15-25	Provide details regarding the use of Local Wireless Communications, including architecture, physical arrangement, and all necessary hardware for the On-Board Processor.	15.3.2.1	PDR, FDR	Yes
CDRL 15-26	Provide details, information, technical specifications, and certifications for the Wireless Broadband Communications system for fixed location devices.	15.3.2.2	PDR, FDR	Yes
CDRL 15-27	Provide details regarding the use of Local Wireless Communications, including architecture, physical arrangement, and all necessary hardware for fixed location devices.	15.3.2.2	PDR, FDR	Yes
CDRL 15-28	Provide full information for all hardware and software for WMATA's business recovery site.	15.4	PDR, FDR	Yes
CDRL 15-29	Provide descriptions of how physical security compliance has been attained for PCI DSS.	15.5.2	CDR, PDR, FDR	Yes
CDRL 15-30	Provide supporting documentation to certify that the system meets the PCI DSS requirements.	15.5.2	CDR, PDR, FDR	Yes

End of Section 15

Section 16 – Central Data System
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16 CENTRAL DATA SYSTEM

This section of the Technical Specification identifies the functional requirements of the Central Data System (CDS). The CDS shall provide a comprehensive approach to monitoring, controlling, maintaining, and managing revenue information throughout the NEPP.

The CDS will include a central database for the retention of NEPP transactional data, consolidated summary data, usage, and operational information for WMATA and its Regional Partners. In addition, the CDS shall feature new applications to provide user interaction between the CDS and authorized users. The CDS shall also provide information to and from WMATA's business and legacy systems.

The CDS shall be provided as a system installed at the Jackson Graham Building, 600 5th Street NW, Washington, DC, also referenced herein as the WMATA IT Data Center with a second, identical Disaster Recovery CDS, installed at the Carmen Turner Facility (CTF) business recovery site.

Alternatively, the CDS, including its primary and secondary instances, may be provided as an outsourced data center, as identified in Section 16.11.

16.1 General Requirements

The CDS shall be the data repository and control location for all NEPP equipment. The CDS shall monitor and control the functionality of all NEPP equipment; collect, store and report data; and clear/settle all customer transactions.

CDS hardware and software shall be designed to meet industry standards for reliability (see Section 2) and availability. All elements of the CDS shall provide stability and reliability levels resulting in system availability of no less than 99.999% of operating time per year.

Networking components of the CDS, including hubs, routers, network interface hardware, and other protocol and interface converters, shall each experience no more than one failure per year. The CDS shall be designed to interface with all of the segments of the communications and network elements outlined in Section 15 to provide a single integrated set of controls and applications for the entire NEPP System. The CDS shall in turn interface with the WMATA business and legacy systems, including those for finance.

The CDS shall be the system by which authorized WMATA personnel will be able to monitor and control the NEPP. It is also the intent of WMATA that all modes and NEPP equipment function as a single fully-integrated system with a unified approach to data formatting, report generation, and downloads for fare tables and other data and software related information. The CDS shall allow authorized users to reconcile actual revenue against recorded revenue, to reconcile recorded revenues against schedules and accurately capture ridership statistics.

The user interface for the entire CDS, as well as all CDS applications, shall be web-based and shall permit authorized users to access the system through web-based applications from any workstation installed on WMATA's WAN (Section 15). The CDS shall also permit authorized system users utilizing web applications to gain access to NEPP system data for report generation. All application software used by the CDS shall be designed to be modular, structured, user friendly, and allow users to access all functions and features through a modern Graphical User Interface (GUI).

All programs and routines, including reports and databases for ad-hoc reporting, shall be based on a single, current, open database compliant, commercially available, relational database, such as Oracle 11g or later, or other WMATA-approved equal. The software shall provide effective data processing and allow for the user update of all database tables, parameters, and operational values in advance of the actual changes taking affect.

The NEPP shall allow for operational parameter tables to be created by the user and tested prior to being implemented across the NEPP. Changes shall be able to be fully tested and verified in a test environment. Historic parameters, operational values, and complete fare tables shall be automatically maintained and stored by the CDS, until purged, as detailed in Section 16.3.4. This shall allow for the generation of reports based on historical data spanning changes in fares and other parameters.

The CDS shall provide transaction control, device polling, event and machine status reporting, provide a secure data repository for all event and transaction data, fare table development and implementation, NEPP system administration (e.g. media stock control, media print layouts), system security, and control of all communications between the machines, servers, and other internal and external systems. The CDS shall be compatible with industry standard monitoring systems used in Network Operations Centers.

A complete description of the functionality of the CDS shall be provided for WMATA review and approval at each stage of the design review with the final document fully describing the operation, capabilities, and functionality of the CDS as described within this Section. Sufficient detail shall be provided to permit verification that all required functions are satisfactorily included. **CDRL 16-1**

16.2 General Software Requirements

The Contractor shall provide all necessary software applications to operate, monitor, and manage the CDS, networks, and all NEPP devices.

The Contractor shall supply all necessary software applications and shall configure all software programs and the database for optimal system performance, including its associated networks. Standard commercially available software packages may be embedded in the system provided. All software requirements stated in this Section shall be applicable to all software utilized within the NEPP CDS.

The Contractor shall provide and install all software necessary for proper operation, including commercial software and operating systems, object code, annotated source code, and documentation together with all required programming tools, text editors, and supporting materials needed for normal operation, monitoring, and maintenance.

All application software shall be certified with the most recent vendor releases of recommended third party software and shall remain certified with newer releases during the term of this agreement. Software shall be completely installed and shall include programs required for start-up, data editing, file processing and report generation to satisfy the requirements identified herein.

All system control, monitoring, and reporting software shall be capable of being run locally on the WMATA standard Oracle WebLogic Application Server or WMATA-approved equal. This software shall also be capable of being run via any of the NEPP servers or a standard workstation connected to this server, via WMATA's WAN (Section 15), utilizing only a standard web-browser.

WMATA shall be able to set up groupings of NEPP equipment, by device type, for ease of monitoring and reporting purposes. WMATA shall be able to set up groupings of similar and different equipment by transit station or garages. These groups shall be able to be uniquely labeled within the NEPP and these group names shall be assigned to a drop down menu.

Groups shall also be able to be added together to form other named groups of the same equipment type. Groups shall consist of:

- Equipment only;
- Groups only; and
- Equipment and groups.

When generating reports, monitoring and reviewing status of equipment, WMATA shall be able to select one of the groups for the function.

The Contractor shall provide licenses for all third party software and core software in accordance with requirements stated in the Contract. The Contractor shall identify all third party software and shall provide WMATA a listing of all software applications and tools used within the CDS at the Preliminary Design Review. **CDRL 16-2**

The CDS shall allow control of designated system operational functions from remote locations.

The CDS software shall control and monitor system access, both for the system as a whole and its separate functions.

All accesses shall be controlled, recorded, and reported to specific locations as identified within these specifications. Access privileges for individual users shall be settable by the system administrator.

High-level security shall be provided to ensure system protection from unauthorized access, tampering, or transmission. Fare table screens shall utilize password protection level of security. Fare table configuration files shall be encrypted using no less than 128-bit encryption to ensure the protection of these configuration files.

To facilitate ease of use, all system functions shall utilize menu driven graphical user interfaces (GUIs). A context driven help function shall be provided.

For those functions common to the different types of NEPP equipment, such as the fare table creation and downloads and the ad-hoc reporting, a single interface point for the function shall be provided. Through the selection of elements on the screen or other similar user-friendly processes, the function shall be performed and the software shall disseminate the proper information to the proper software modules for transfer to the different types of fare collection equipment.

All fare application software shall be certified with the most recent vendor releases of recommended third party software and shall remain certified with newer releases during the term of this agreement.

16.3 System Architecture

The CDS shall be designed as a set of scalable applications. The use of suitable scaling and high availability clustering techniques and technologies to properly size and configure the system to address both current and future needs shall be provided in the overall system architecture design. The overall system architecture design shall be provided by the Contractor to WMATA for review at the Conceptual Design Review and for approval at the Preliminary Design Review. **CDRL 16-3**

The overall architecture of the CDS shall serve to isolate those functions supporting fare issuance, fare payment, revenue process operations, revenue reconciliation and ridership reconciliation, making them independent of all other CDS functions. The objective is to ensure that changes to and use of all other functions shall not affect the primary activities of the system.

Examples of such non-media and networking functions include, but are not limited to:

A. Reports and Queries;

B. Fare Table Creation/Editing;

C. System and Device Monitoring;

D. System Configuration and Control;

E. Revenue management and reconciliation;

F. Ridership management and reconciliation;

G. Smart Media Design; and

H. NEPP Device Software Updates.

The CDS design shall be sufficiently robust, and to the extent possible, automatically isolate and/or recover from errors. The system shall employ IBM AIX Unix pSeries server or WMATA-approved equal.

Data communications equipment used by the CDS shall be service proven commercially available equipment employing and supporting industry standards and protocols. The detailed design of the CDS shall be developed by the Contractor for WMATA's approval.

CDS software programs shall be open and modular in design. Modules should be able to be modified, recompiled, and replaced with a goal of isolating all affected changes to a specific function.

The CDS shall utilize Oracle® 11g or later, or a WMATA-approved alternative as a database engine. The Contractor shall provide technical information on the database engine selected. **CDRL 16-4** The CDS shall provide a suite of standard reports (see Section 16.5.1), which shall provide all basic information necessary to operate, maintain, and analyze fare system performance and revenue and ridership data. Additionally, WMATA shall have the ability to generate reports using the CDS database in an ad-hoc manner through the use SQL, or Crystal Reports 2008 or above release.

The CDS shall be designed so that data is backed up to allow full recovery of the system (operating system, application software, database, utilities, and all data and transaction files) with no loss of data integrity. Data back up shall not require the CDS to be taken off-line or out of service for any amount of time.

The system shall provide for the automatic archiving at user programmable time periods of all transaction data and critical core software to secure media without user intervention. Contractor shall provide a description of how the system performs all data back-up and archiving for WMATA approval at the Final Design Review. **CDRL 16-5**

16.3.1 Network Architecture

The CDS shall be established on its own LAN, separate of both the existing WMATA WAN and all Communications networks outlined in Section 15.

All CDS servers shall be part of a single CDS Domain.

16.3.2 Data Transmissions

All NEPP equipment, including mobile devices, shall be in constant communications with the CDS. NEPP equipment shall be capable of providing unsolicited data transmissions to the CDS at any time. With this, the CDS shall be able to handle communications from any combination of NEPP equipment at any given time.

All NEPP equipment shall be capable of being polled at any time the device is connected to or in communications with the NEPP network, whether it is in revenue service or not. Data communications equipment used shall be service-proven commercially available equipment employing and supporting industry standards and protocols, including but not limited to TCP/IP, HTTP, and SNMP. Data, including sales, event, usage, and error data, shall be transmitted from each item of equipment for pre-selected and user modified time periods and available on demand. Received data shall be automatically processed and populated into all pertinent databases. The system shall record the date and time data was received from each device.

Transaction information shall include transaction number, payment information (as identified in Section 2), Smart Media usage, plus all other information including card/media serial number to provide a complete, unique and auditable transaction record.

The CDS shall be capable of transmitting, receiving, processing, and storing data including simultaneous receipt and transmission of data to and from NEPP equipment, while receiving report queries from users, data transmissions to/from the workstations and requests from other portions of the NEPP network. In addition, the CDS shall track all data transmissions from each NEPP field device, and verify that the transmitted data has been properly received by the NEPP Database Server (NEPPDS). Once a transmission of data from a NEPP device has been successfully received and stored by the CDS, an acknowledgement statement shall be returned to the proper device. This acknowledgement shall serve as the notification to the device that the data has been replicated, and can be deleted from the NEPP device's local memory.

All software and event error code tables shall be available for editing through the CDS. Software and updated tables for error codes and event messages shall be available for remote and automatic download to the appropriate equipment where they shall be resident.

16.3.3 Data Redundancy

The CDS shall be designed so that all data is stored redundantly. Redundancy shall be maintained throughout the system, and culminate when two verified backup copies are archived.

Redundant information shall be stored so that no subsystem failure shall compromise copies of the data.

The system shall include appropriate archival hardware and media.

Procedures, documentation, and training shall be provided for restoration of data from the various redundant sources in the event of failure in primary data storage, transmission or the NEPPDS itself. The Contractor shall provide details and information on the data redundancy scheme employed to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 16-6**

16.3.4 Fault Tolerance

The CDS shall provide for the automatic backup and archiving of all transaction data and critical core software to separate and secure storage media, at user programmable time periods without user intervention. The backup and archiving process shall clearly define the appropriate verification, recovery, and restoration procedures to allow full recovery of the CDS to its state prior to failure, and clearly demonstrate a successful process without duplication of data or loss of data integrity. There shall also be defined processes for automated data archiving. This process shall include both onsite backups for fast restoration and off-site backups for disaster recovery.

The Contractor shall define the backup and archive media as well as the associated procedures for both backup and archiving. The Contractor shall provide details of these fault tolerance processes to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 16-7**

16.3.5 Disaster Recovery

The Contractor shall design the CDS to be incorporated into WMATA's Disaster Recovery Plan. This includes the establishment of a second, identical CDS (Disaster Recovery CDS), to be deployed at WMATA's business recovery site, the Carmen Turner Facility (CTF). Both instances of the CDS shall be in constant communications via a fiber optics communications link supported by MetroNet. Through this link, each CDS shall be maintained as a mirror image of the other. With this, all functions of the CDS shall be available simultaneously at either instance of the CDS.

Only one instance of the CDS shall control the NEPP at any given time. The CDS within WMATA's IT Department's Data Center (primary CDS) shall exercise primary control over the NEPP. In the event that the primary CDS within WMATA IT Department's Data Center is forced offline for any reason, the Disaster Recovery (secondary) CDS at the business recovery site shall seamlessly and automatically assume control of the NEPP. When the primary CDS returns to service, an automatic process shall return control of the NEPP to the primary CDS and cause all data recorded by the Disaster Recovery CDS while the primary CDS was out of service to be copied to the primary CDS.

Alternatively, the Contractor may propose to satisfy the Disaster Recovery requirements by establishing the second, identical CDS and implementing a Load Balanced solution across the two instances of the CDS for WMATA consideration. Should the Contractor choose to propose such a solution, the Contractor shall provide all details of this solution including all measures which will ensure uninterrupted CDS operation in the event of a failure or reduced functionality of either one of the instances of the CDS sites.

The Contractor's proposed solution shall be provided to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 16-8**

16.4 CDS Servers

16.4.1 General Hardware Requirements

All servers provided as part of the CDS, as shown in Figure 16-1, shall consist of computers and all necessary ancillary equipment. The servers and peripherals shall be state-of-the art commercially available computers, suitable for server functions, with properly sized memory and data storage.

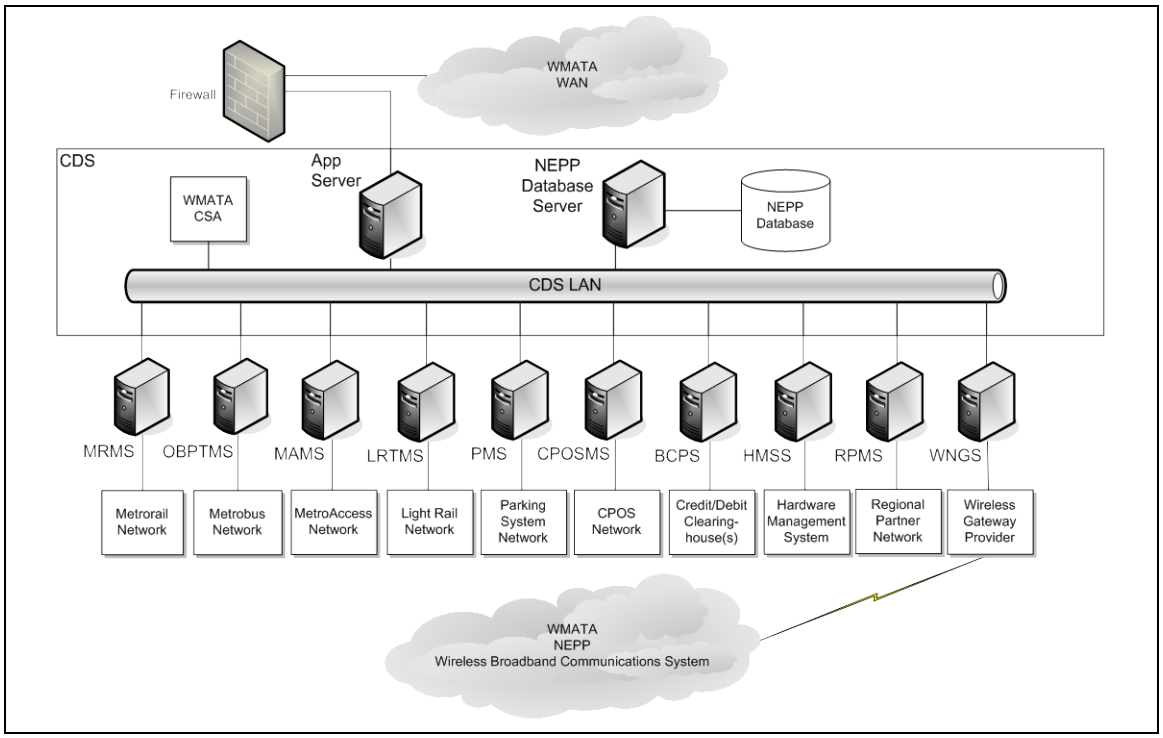

Figure 16-1 – CDS Servers

All servers shall incorporate service proven, industrial grade commercially available 64-bit processors in compliance with the WMATA's *Professionals' Guide to Information Technology Standards and Services for Metro* (WMATA IT Standards) at the time of NEPP Contract award. All servers shall be capable of joining to a cluster, and shall support the ability to maintain, diagnose, and update the system by isolating one-half of the system from production.

All servers shall be designed to comply with WMATA's storage management standards as defined in the WMATA IT Standards at the time system deployment or a WMATA-approved equal.

The servers shall have adequate capacity to retain data until redundant copies have been made and verified per the requirements of Section 16.3.3.

All CDS server hardware, operating systems, and relational database managers shall be from OEM suppliers approved by WMATA.

The Contractor shall provide all computer hardware (central processing assembly, keyboard, video display, mouse, and all other necessary peripherals) with sufficient processing, memory, expandability, and data storage capacities to support successful operation of the CDS.

CDS capacity and performance shall meet the following criteria:

A. The system shall have adequate capacity to retain data until redundant copies have been made and verified elsewhere.

B. System shall have at least 100% excess storage and processing capacity, to be demonstrated by actual system operation.

C. Support for a minimum of 10,000,000 daily data transactions.

D. The hardware shall support and be compatible with all proposed software, and effectively process all events and transactions from the devices that are being furnished and shall provide sufficient capacity to accommodate a 50% increase in the number of devices and transactions.

E. To ensure security of credit/debit card customer PIN numbers, all transmissions from the CDS to outside services/switches and from/to the smart media sales equipment shall utilize a hardware encryption device that employs AES and satisfies all current PCI DSS requirements. The Contractor shall ensure that as PCI standards change, the system is maintained as PCI compliant by the required deadlines.

F. The CDS shall have redundancy to enable continued operation of critical security functions or of transaction functions without degradation that is obvious to the user.

All CDS servers shall be delivered to WMATA with an integrated Uninterruptible Power Supply (UPS) and software with sufficient battery capacity to power for at least one-hour on battery power and provide a subsequent orderly shutdown.

The Contractor shall provide all necessary computer hardware to ensure that the CDS has no single point of failure.

Final design details, including server manufacture, model, and other hardware selection is subject to WMATA's review and approval at the Final Design Review. **CDRL 16-9**

16.4.2 NEPP Database Server

All data associated with this system shall be retained on the NEPP Database Server (NEPPDS). Contractor's use and implementation of the database shall not contain any non-standard or proprietary instructions or commands.

The NEPPDS shall store all data relating to the operation of the NEPP system in one relational database, consisting of multiple tables, stored procedures, and queries. The NEPP database shall be open database compliant such that data may be exchanged as necessary with other compliant applications. The database manager shall support standard Structured Query Language (SQL) commands and queries.

Database tables and relationships shall be designed and developed to minimize the time required to perform queries and to generate reports without adversely impacting the operation of any other system functions.

Through the use of a Database Server, the Contractor shall provide WMATA with the means to configure all database tables, relationships, system queries, and automated procedures. This shall include all necessary functions to generate and modify queries and to integrate with other software applications.

The AES encryption standard shall be employed to encrypt any debit/credit card data stored in the database. The encryption key management shall satisfy PCI DSS requirements.

16.4.2.1 Summary Level Information

The CDS shall automatically generate daily summary reports from the detailed transaction detail. This summary level information shall provide daily revenue and passenger totals by station/stop, route, mode, etc. This summary level information shall not include any detailed transactional data. As such, the CDS shall generate these reports, at the close of business each day, from the detailed transaction records. Data included and format provided for the summary tables shall be provided to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 16-10**

16.4.2.2 Database Retention

The NEPPDS shall store all transactional information for a pre-defined amount of time in the defined database format (Section 16.4.2). This time period shall be initially defined as seven (7) years and shall be modifiable by an authorized user of the CDS. During this time period, transactional data shall remain available through the NEPPDS and the CDS applications.

The CDS shall automatically move detailed transactional data older than this period of time, to off-line storage per the requirements of Section 16.3.3, and then delete it from the database.

While no longer loaded within the NEPP database, older transactions data shall be archived daily and shall be readily available for retrieval, reporting, and query purposes. The Contractor shall provide an archive catalog to maintain the relationship between archived data and CDS information such as, but not limited to, database version and CDS version.

At no point shall the summary level, generated as outlined in Section 16.4.2.1 be automatically deleted.

16.4.2.3 Fare Tables

The fare tables are an extensive set of tables that define the policies and prices for each transaction type. The fare table entries shall include all elements that are necessary to properly define the entry (e.g., the button assignment for a product, its price, the text to print on the media, data to be encoded and the format of this data, and the audio message to be played) and other required sales information and functionality to meet the NEPP system requirements.

Fare tables shall support fare changes based on media types as well as on an exception basis. Exception-based changes include fare changes for an entire service, line/route, or a branch and down to the individual location. Similarly, means shall be provided to program special fares for designated special events such as sporting events for specific services, routes, line segments, and stations/stops. Fare tables shall be identified by the date and time they become effective as well as with a unique version number.

The software shall provide menu options to create, edit, display and/or print, and download to the end devices the fare tables are used to generate media and receipts, to collect cash fares, to validate machine-readable Smart Media, and all other fare transactions. The “create” and “edit” functionality shall be coded so that it can be executed independently, if necessary. The fare table generation and manipulation software shall be maintained by and operated via the CDS.

Automated processes shall be put in place to copy any existing fare table effective-date to a new effective-date. This will reduce manual data entry by requiring the support staff to only key changes.

The NEPPDS, shall be able to actively retain at least 100 fare tables. This shall include the current fare table, as well both previous tables and those that are in development and test for future deployment.

The ability to access fare table routines and files shall be controlled through a separate layer of user security.

Records shall be kept of all changes made to fare table components and associated files by user ID, date, time location, and modification made. At the device level, fare tables and associated files shall be tamper proof.

The CDS shall provide the options to download all stored fare tables into a spreadsheet for manual update, with subsequent upload of the spreadsheet to the database.

In the event of a network failure, means shall be provided to create a file for manual transfer to and from all NEPP devices via backup media.

16.4.2.4 Fare Flexibility

For maximum flexibility and to provide the ability to accommodate future WMATA fare policy requirements, the NEPP System shall be able to create accounts, linked to Smart Media, LUM, or other media types identified herein, that support the present fare types available and offered by WMATA as well as other fare types not presently offered by WMATA. These accounts shall support fare types that include, as a minimum:

- Stored value (with and without transfer capability);
- Stored trip (single-trip, round-trip and multi-trip with and without transfer capability);
- Tag-on at the origin location and tag-on/tag-off at intermediate and destination locations:
    - With the appropriate charge calculated for the trip;
    - With a default fare charged if the customer does not tag-off for the trip;
    - With the pass/ticket validity verified at each location;
    - With settable parameters for the amounts of time between origin, intermediate, and destination locations.

  Intermediate locations may include transit stations/stops where Customers may leave and re-enter the transit system for a free or discounted fare amount. Customer travel between such intermediate locations shall be capable of being settable separate from any restrictions on the number of valid transfers.
- Fixed period passes (calendar based) including the ability to limit the number of usages of the pass for any calendar period (e.g., day, week, month, etc.) and for the entire pass period;

- Floating period passes including the ability to limit the number of usages of the pass for any calendar period (e.g., day, week, month, etc.) and for the entire pass period;
- Upgrades to other services;
- ID cards;
- Special event media including:
    - Transportation to/from a special event;
    - Transportation to/from a special event together with media for the special event itself;
    - Media for the special event itself provided that the customer has valid transportation for the date of the event.

In the event that a special event media item is issued, it shall include, in addition to fare validity information, the name of the event, the start date of the event, the end date of the event and additional information as identified by WMATA at the Final Design Review.

The NEPP System shall be able to process multiple passengers on a single item of Smart Media. The Smart Media shall be able to accommodate accounts which support:

- WMATA fares which accommodate multiple customers, including the Freedom Pass; and.
- Pay as You Go (PAYG) fares:
    - If the Smart Media account includes a calendar or period pass: the initial fare shall be processed as a pass transaction and subsequent transactions as Adult stored value transactions:
    - If the Smart Media account does not include a calendar or period pass: all transactions shall be processed as Adult stored value transactions:

WMATA shall be permitted to add, delete, and modify, via the CDS, the fare types linked to accounts and accepted by each of the NEPP System equipment types without Contractor intervention. These fare types shall also be assignable to accounts with one or more of the following configurations:

- Customer type (e.g., full fare, child, student, senior, disabled, employee, senior/disabled with companion(treated as a single fare));
- Boarding/exiting station/location/route;
- Peak, off-peak, no restrictions and with restrictions for multiple peak/off-peak times during the day, settable for each day of the week;
- Day of week restrictions plus validity start and end time for each day of validity as well as for each day of the week;
- Service type (e.g., local bus, subway, Commuter rail, light rail (street car);
- Anti-passback checking or no anti-passback checking;
- Fare validity type (e.g., fixed period pass, stored value, trip-based, pending period pass, free trip).

Dates and times for activation and deactivation for each shall be able to be assigned to each fare type/customer type combination. This shall provide for these fares to be displayed and sold on specific dates, days of the week and for specific time periods. The addition or modification to existing fares accepted and processed by the NEPP System shall be easily completed via the CDS without any intervention from the Contractor or any of its sub-contractors.

The NEPP System shall provide the capability, through WMATA-modifiable controls, to provide for customer incentives for processing of all Smart Media-based fares. These incentives shall be in the form of purchase discounts, frequent rider bonus plans, add-value bonuses, free companion access/travel and service guarantee refunds. Any or all of these incentives shall be able to be assignable for the Smart Media account.

Accounts shall be set up for Smart Media to meet the functional requirements. The accounts shall remain anonymous unless the customer registers the account. Once registered, the customer shall be able to link the account to a credit account, debit account or other payment method as identified in Section 4, for automatic replenishment and for balance protection purposes. Accounts shall also be able to be set up to accommodate Federal and local institutions and services, and these shall be able to accommodate unlimited number of different Smart Media in a single account.

16.4.2.5 Fare Activation

The NEPP equipment shall permit any valid fare stored in a customer's account to be activated for immediate use, based upon pre-set selections by the customer. These actions shall be able to be performed at any PPT, via the Internet and through the NEPP Customer Support Center. Prior to the date and time of activation selected by the customer, the customer shall be able to reverse any activation of a fare product selected; activation reversal shall be available via the Internet and the NEPP Customer Support Center only.

16.4.2.6 Fare Issuance and Verification

Fare validity shall be verified according to the fare policies determined by WMATA. Fare validity shall be positively ascertained each time Smart Media is properly presented to a PPT. Only one Pre-Funded fare product (such as a trip-based or a time-based fare product) shall be permitted to be loaded in an account at any one time, and the CDS shall also enable customers to load stored value to the same account in addition to the Pre-Funded product. The CDS shall be able to record all Pre-Funded fares purchased for the account, applying all fare policies, and reporting usage of the WMATA-issued Smart Media throughout the NEPP System.

Validity shall be determined by the CDS and validity data shall be stored in the CDS.

16.4.2.7 Historical Data

The Contractor shall migrate all WMATA historical data from WMATA's existing legacy systems, which are outlined as being replaced by the NEPP.

The Contractor shall develop a plan for this migration and submit it to WMATA for review and approval. **CDRL 16-11.** This plan shall identify all sources of WMATA legacy data, identifying all data fields and how these fields shall be translated into the data structure defined for the NEPP Database.

As part of this Migration Plan, the Contractor shall identify an approach for the transition of data from the legacy systems to the NEPP Database for all data collected during the deployment of the NEPP, while the legacy systems are still in operation.

16.4.3 Domain Controller

All CDS servers shall be part of the CDS domain. This domain shall be under the control of the CDS Domain Controller. This server shall manage all user privileges for the system. In addition, the Domain Controller shall distribute patches and updates across the CDS domain.

The Domain Controller shall establish the standard time that will be used throughout the system. The network management servers (Section 16.4.4) shall synchronize with this time and ensuring that all NEPP field devices are also synchronized with this time.

16.4.4 Network Management Servers

The CDS shall employ a set of servers that shall transmit data between the CDS and the NEPP devices. There shall be a server assigned to each data network outlined in Section 15 (See Figure 16-1). Each server shall be responsible for all data communications between all NEPP devices associated with a network, and the components of the CDS. This includes connecting devices to the NEPPDS and all software applications. These servers are outlined in Table 16-1.

The Network Management Servers shall synchronize the time of all NEPP field devices with the CDS time, as set by the Domain Controller. This Domain Controller shall obtain the current time information from WMATA's existing time server. The Contractor shall submit its plan for time synchronization for WMATA's review and approval. **CDRL 16-12**

All Network Management Servers shall meet the requirements outlined in Section 16.4.1. In addition to these requirements, all Network Management Servers shall consist of a computer and all necessary ancillary equipment. Each server shall provide a communications link between the CDS and all NEPP equipment on its communications network. This includes being able to perform all functions for transmittal and retrieval of information with any item of NEPP equipment and any other item of network hardware.

All Network Management Servers shall be capable of simultaneous (asynchronous) receipt of data from all stations, depots or facilities located on its network. All servers shall be capable of simultaneous receipt of data from one or more devices while data is being transmitted to one or more devices. All servers shall be capable of simultaneous receipt and/or transmission of data to/from NEPP field devices while processing report queries from workstation users as well as requests from other system components.

Data processing and transmission rates shall be capable of supporting all of the defined transaction processing times outlined in Section 2. Additionally, patrons shall perceive no delays due to equipment interaction with any Network Management Server. Workstation users shall not experience unreasonable delays due to equipment interaction with any Network Management Server.

Table 16-1 – Network Management Servers

Server	Locations Controlled	Network Communications
Metrorail Management Server (MRMS)	Metrorail Stations	Metrorail Network
On-Board Bus Payment Target Management Server (OBPTMS)	Metrobus Depots	Metrobus Network
MetroAccess Management Server (MAMS)	MetroAccess Depots	MetroAccess Network
Light Rail Transit Management Server (LRTMS)	Light Rail / Streetcar Stations and Depots	Light Rail / Streetcar Network
Parking Management Server (PMS)	Parking Garages and Lots	Parking Systems Network
Customer Point of Sale Management Server (CPOSMS)	Customer Sales Locations	Customer Point of Sale (CPOS) Network
Bank Card Processing Server (BCPS)	CDS Primary and Secondary sites	Bank Card (Credit/Debit) Clearinghouse Network(s)
Hardware Management System Server (HMSS)	CDS Primary and Secondary sites	Hardware Management System (Vendor Specific) Network
Regional Partner Management Server (RPMS)	Regional Partner Control Centers	Regional Partner Network
Wireless Network Gateway Server (WNGM)	CDS Primary and Secondary sites	Wireless Network Gateway Provider

16.4.4.1 MetroRail Management Server

The Metrorail Management Server (MRMS) shall manage all operations on the Metrorail Network (see Section 15). As such, all NEPP equipment on the Metrorail network shall communicate with the MRMS for the transfer of all stored data and equipment parameters.

It shall be possible to utilize the Metrorail Network to expand data coverage for the Metrobus and Regional Partner bus fleets. This would require a wireless access point for bus OBPT communications being connected to the network. As such, the MRMS and OBPTMS shall interact for the successful transmittal of related data.

16.4.4.2 On-Board Bus Payment Target Management Server

The On-Board Bus Payment Target Management Server (OBPTMS) shall manage all operations on the Metrobus Network (see Section 15). All OBPTs on Metrobus routes shall communicate with the OBPTMS, over the OBPT Network, for the transfer of all stored data and equipment parameters.

It shall be possible to utilize the Metrorail Network to expand data coverage for the Metrobus fleet. This would require a wireless access point for bus OBPT communications being connected to the network. As such, the MRMS and OBPTMS shall interact for the successful transmittal of related data.

16.4.4.3 MetroAccess Management Server

The MetroAccess Management Server (MAMS) shall manage all operations on the MetroAccess Network (See Section 15). All HSDs on MetroAccess vehicles along all MetroAccess routes shall communicate with the MAMS via the NEPP Wireless Communications Network for the transfer of all stored data and equipment parameters.

16.4.4.4 Light Rail Transit Management Server

In the Light Rail environment, WMATA envisions the customer's primary interface with the NEPP to be through FVDs and Platform Validators (PVs). It is envisioned that the HSD shall be used to read and validate fare payment using the smart media or LUM.

The Light Rail Transit Management Server (LRTMS) shall manage all operations on the Light Rail Network (see Section 15). All NEPP equipment on the Light Rail network shall communicate with the LRTMS for the transfer of all stored data and equipment parameters.

Light Rail system FVDs and PVs, and HSDs shall communicate with the LRTMS via the NEPP Wireless Communications Network (see Section 15) for the transfer of all stored data and transfer of equipment parameters. The LRTMS shall be responsible for all data related communications between the HSD and the CDS.

16.4.4.5 Parking Systems Management Server

The Parking Systems Management Server (PMS) shall manage all operations on the Parking Systems Network (See Section 15). All NEPP Parking Systems equipment shall communicate with the PMS for the transfer of all stored data and equipment parameters.

It is anticipated that the NEPP Wireless Communications Network may be utilized to integrate new parking equipment into the NEPP. The system may encompass wireless parking equipment. The PMS shall be responsible for all communications between such equipment and the CDS.

16.4.4.6 Customer Point of Sale (CPOS) Management Server

The Customer Point of Sale (CPOS) Management Server (CPOSMS) shall manage all operations related to the CPOS devices such as the Customer Service Terminal (CST) at WMATA retail sales locations. As such, the CPOS devices shall communicate with the CPOSMS for the transfer of all stored data and equipment parameters.

16.4.4.7 Bank Card Processing Server

The Bank Card Processing Server (BCPS) shall process all credit and debit card transactions across the NEPP. The BCPS shall support the functions defined in Section 17.

The BCPS shall have cluster capabilities. Multiple BCPSs shall be built into the cluster. Each BCPS in the cluster shall provide all functions specified above in this Section.

16.4.4.8 Hardware Management System Server

The Hardware Management System Server (HMSS) shall manage all operations of the Hardware Management System provided by the equipment supplier. The HMS shall receive all requests and commands from any CDS operation and relay them, as appropriate, to the respective field devices. As such, the HMSS shall support the functionality of the HMS and shall provide reliable transfer of data between the CDS and all NEPP hardware provided by a single supplier.

HMS data processing and transmission shall be at a rate suitable for the required task. Customers and system users shall perceive no delays due to equipment interaction with the CDS via the HMS.

16.4.4.9 Regional Partner Management Server

The Regional Partner Management Server (RPMS) shall manage the interfaces of all Regional Partner NEPP Systems with the CDS. As such, all NEPP equipment on the Regional Partner System shall communicate with the RPMS for the transfer of all stored data and equipment parameters to the CDS. The RPMS shall be implemented such that access to each Regional Partner's data is restricted to that Regional Partner.

16.4.4.10 Wireless Network Gateway Server

The Wireless Network Gateway Server (WNGS) shall manage and interface all NEPP mobile devices to the NEPP Commercial Wireless Broadband Network (see Section 15). All NEPP equipment on the NEPP Wireless Broadband Network shall communicate with the WNGS for the transfer of all stored and operational data, and the transfer of equipment parameters.

16.4.5 Application Server

The Application Server shall operate all NEPP system reporting and management applications. As such, all other NEPP servers shall communicate with the Application Server for transfer data and instruction to the software applications. These applications are outlined in Section 17.

The Application Server shall consist of a computer and all necessary ancillary equipment. This system shall provide the necessary link between the end-user applications and all of the other NEPP servers. This Application Server shall be capable of simultaneous (asynchronous) receipt of data from all other servers. The server shall also be capable of simultaneous receipt of data from one or more servers while data is being transmitted to one or more other servers. In addition, the system shall be capable of simultaneous receipt and/or transmission of data to/from servers while processing report queries from workstation users as well as requests from other system components.

The Application Server shall serve as the bridge been the NEPP Network and WMATA's existing WAN (Section 15). Users from any workstation on WMATA's WAN shall be able to access NEPP applications, via a web browser. Through the applications on this server, users shall be able to monitor and configure NEPP devices and CDS servers.

The Application Server shall have cluster capabilities. Multiple Application Servers shall be built into the cluster. Each Application Server in the cluster shall provide all functions specified above in this Section.

16.4.6 Server Virtualization

WMATA envisions the use of the AIX LPARS server and WebLogic Cluster, or a WMATA-approved equal to fulfill the NEPP Application Server requirements (see Sections 16.2 and 16.3). The Contractor shall not deploy the NEPP servers as Virtual Machines (VMs).

16.5 Software Requirements

The Contractor shall provide all necessary software applications for operation, monitoring, and management of the CDS, all networks, and all NEPP devices.

The Contractor shall develop at a minimum, the software applications shown in Table 16-2. This list does not represent an exhaustive list of software required by the NEPP. The Contractor shall develop any additional software identified by WMATA necessary to operate, monitor, and manage the CDS, all networks, and all NEPP devices.

Table 16-2 - NEPP Software

Applications	Primary Functions
Reporting System	Generate System Reports and Queries, including data from all systems. This produces all queries and reports currently available
Configuration Manager	Manages Configuration of all Hardware
Fare Table Manager	Provide Functions to Create, Edit, Manage, and Download Fare Tables
Revenue Accountability System	Provide Revenue Oversight and Auditing Functions
Smart Media Manager	Manages of all Smart Media Functions including Smart Media distribution, tracking and fraud detection.
Station Manager	Monitors Activities and Hardware at all Stations
Status Monitor	Reports Real-Time Status of all Devices, Stations, and Communications Links

16.5.1 Reporting System

The Reporting System shall have an application for all aspects of its reporting capabilities. This application shall allow the user to retrieve standard reports. These reports shall include the reporting functions outlined in Section 16.3. This application shall be capable of running reports on demand or at predefined times. Users shall be capable of printing reports as well as exporting to common software application formats, including Microsoft® Word (.doc, .docx), Microsoft® Excel (.xls, .xlsx), and Adobe® Portable Document Format (.pdf).

The Reporting System shall also permit authorized users to design customized reports. This feature shall allow users the ability to select, sort, and summarize data on associated fields, such as device, station, or time period. The system shall provide the user with the abilities to generate reports utilizing various data sets, with grouping, sorting, and totaling capabilities. With this, menus and screens to support the generation of reports, as well as the timing and location of the resulting output shall be provided. The application shall present the user with easy to use tools for report generation but shall also allow for the use of SQL.

Reports and queries shall be capable of being executed as they are created and shall be capable of being added to the menu of queries and reports. Customized queries and reports shall be treated by the CDS the same as any Contractor-supplied query or report. Authorized users shall also be able to edit and delete any customized query or report.

WMATA shall have the ability to generate reports using the CDS database in an ad-hoc manner through the use of WMATA preferred and currently utilized reporting tools such as SQL and Crystal Reports 2008, or above releases.

The output format of all reports shall be consistent with the format of comparable reports currently produced by WMATA end users.

Predefined input forms for all information to be entered by system users shall be provided. These input forms shall be displayed on screens and provide “fill-in-the-blank” simplicity of use. Each blank on the input form shall correspond to a field in the associated database table. The general design of input forms shall be submitted for review at the Preliminary Design Review. **CDRL 16-13**

The Contractor shall provide prepared report formats at time of system and prototype testing. The reports and queries shall be presented in a menu form for selection at any time. Each shall have access permissions assigned to limit availability to those users authorized to utilize the query or report. Users shall have the option of routing standard report outputs to a workstation screen, a downloadable file, a temporary file for subsequent use, or to a selection of printers (either network or remote).

The validity of presented data shall be indicated on each query and report. If an item of equipment is not polled, query and report outputs shall clearly indicate for which items of equipment data is not included.

16.5.1.1 Queries and Reports

It shall be possible at the CDS to query any item of NEPP data stored within the systems, including transactional information, alarms, status changes, and all other elements stored as transaction records. This shall include historical records as well as current information. If required, archived data shall be loaded.

All data received from NEPP devices shall be retained by the CDS on the NEPPDS.

16.5.1.2 Standard Reporting

The CDS shall provide the capability to query the system database to produce reports for auditing, cash and ticket control, planning, fare management information, maintenance, and other similar requirements. This functionality is presented in Section 17. The software shall be provided to enable authorized users to view predefined reports.

In addition, this application will allow authorized users to develop new or modify existing queries and reports. Preprogrammed reports shall be generated by the report generation package outlined in Section 17.

The ODBC compliant database(s) on the NEPPDS shall permit access to the data files with other database programs to produce reports, in addition to those provided by the Contractor.

The need for historical data analysis requires the system to have the ability to produce reports that span two or more changes in fare structure or level without special programming.

The system shall include reports that address the following:

16.5.1.3 Revenue & Ridership

A. Boardings: A report showing entrances at a station or group of stations by media type for a specified date or range of dates; service type or day of week; for a specified time period during the day. Intervals within the time period shall be specifiable down to a one minute degree of precision.

B. Budgeted vs. Actual Revenue: Anticipated revenue budgeted for a given period vs. actual revenues received for the same time period.

C. Credit / Debit Media Sales by Type: A report detailing all credit and debit transactions by type, both media type and credit type (Visa, American Express, etc.) for use in auditing the settlement of charges. This information shall be further segregated by date and by location. This report shall be produced under compliance with PCI rules.

D. Credit/ Debit Media Transactions: A report detailing all credit and debit transactions attempted and identifying transactions types by measure of transaction outcome, i.e. successful, failed, reverse transaction, etc. This report shall be produced under compliance with PCI rules.

E. Customers Onboard Report: A real-time total showing the number of customers believed to be onboard at a specified time by media type. This report shall be calculated by summing total boardings for the day less total exits.

F. Invalid Media List Report: A list of all media that will not be accepted by the NEPP.

G. Media Registration List: A database listing of all smart media currently registered with WMATA, with a record of pertinent data for each type of smart media holder (e.g., name, address, telephone number, rider class, employer ID (if applicable), automatic replenishments and authorized thresholds.

H. Media Reload Transaction Summary: A report showing the total number of value reload transactions by location and payment type.

I. Media Sales: Number and total dollar value of sales, by type, and payment method; with breakout by location and device.

J. Media Use Report: A report showing all transactions for a given media type, media serial number, list of serial numbers, or range of serial numbers. In addition, the system shall have the ability to specify all cards purchased or used during a given time span at a particular station.

K. Origin/Destination: Original origin of linked or single rides shall be paired with the origin of the next linked or single ride to produce origin / destination pairs. Totals shall be displayed for the number of trips for each pair.

L. Revenue Model Allocation Report: A report detailing the availability of the actual allocation percentages and ride factors by period, which can be used for analysis and trend information.

M. Revenue Model Report: A detailed report of revenue and ridership assigned by fare instrument, by mode by district.

N. Revenue Model Summary Report: A summary level report of revenue and ridership assigned by fare instrument, by mode, and by district.

O. Ridership: Total ridership. System-wide, this shall show both linked and unlinked rides; by station, this shall show both entrances and exits from station. Ridership profiles by time of day, day of week, service type (weekday, Saturday, or Sunday), line, line segment, station, and by month shall be generated with this report. Rides shall be linked if subsequent rides are taken within a user selectable time limit of a previous ride. Different time limits shall be settable for each mode.

P. Transaction Detail: A report listing all transactions, in detail, together with time date, device number, location and media type.

Q. Transaction Summary: A report showing the total number of patron and service transactions, by transaction and media type.

16.5.1.4 Status & Maintenance

A. Cash Module Report: A report identifying the location of each bill vault, coin vault and change module and the time and date of its last change-out.

B. Component Failure Report: A report listing assembly failures, type of defect, time and date of failure, device ID and component ID (if applicable).

C. Device Activity Logs: A report depicting each activity that occurs at a NEPP device. This report shall show the activity and the date and time that this activity occurred.

D. Device Availability: A report providing a snap shot in time with a summary and detail listings of the fare devices in & out of service, and the percentage of the total population in service.

E. Device Service History: A report listing all failures and service events, by NEPP device.

F. Error Logs: A report of each error that occurs at the various fare devices. This report would depict the specific error code, description, and date and time that this error occurred.

G. Failure Report: A report listing equipment failures, type of defect, time and date of failure, media, device ID and component ID (if applicable).

H. Jammed Media Report: A report detailing all partially printed or non-printed media indicating the percentage of media printed, if any, if a transaction was completed, and was money returned or accepted.

I. Maintenance Management Reports: Reports showing planned preventive and corrective maintenance work, by crew, as scheduled by the maintenance tracking system. Reports shall also be available showing due and overdue maintenance, by type of maintenance, by location or equipment type.

J. Parts Inventory: A report listing all serial numbered parts and subsequent exchange activity, including prior and current serial numbers.

K. Polling: A report showing the status of polling data from each device to the central computer system.

L. Service Employee Activities: A report of all employee interactions with the fare devices. This report shall include device number and location, time and date of entry and exit, and actions taken.

M. Service History: A report listing all failures and service events. As an option, an analysis of MTBF, MTTR, and / or MCBF should be included, as applicable.

N. Stock Control: A report indicating all current media numbers in FVDs as well as any stock exchange activity, including prior and current numbers.

16.5.1.5 Reconciliation

A. Bank Deposits: Detail of all components of bank deposits (coins, bills and checks by type and amount), by deposit number.

B. Close Down Reconciliation: A report for each device, showing total sales by payment method and sales category, expected vault contents, actual counts, and variance; generated by query and automatically when any unit storing cash is removed.

C. Coin Activity Report: A report detailing device coin exchange activity, including prior and replenishment contents of affected receptacles, and listing all current quantities of coin receptacles

D. Credit and Debit Error Log: A report detailing credit & debit rejection codes and transaction status.

E. Daily Reconciliation: A report for each device showing total sales by payment method and sales category, expected vault contents, actual counts, and variance; generated automatically on a daily basis at a pre-set time (initially set at 3:30am).

F. Employee Activities: A report of all employee interactions with the NEPP system. This report should include device number and location, time and date of entry and exit, and actions taken.

G. Fraudulent Media Use: A report listing media usage by media type, which violates system standards. The transaction database shall be checked for altered media values, illegal serial numbers, and usage at different stations, which violates minimum transit time between station standards.

H. Cash Room Facility Vault Activity: A report, by denomination, of all transactions into or out of WMATA's Cash Room Facility vault. This report shall also include the purpose of the transaction - e.g. bank deposit, device receipts, device stocking, etc.

I. Variances: A historical report of all shortages and / or overages in the inventory control process. This report shall include NEPP device number, vault numbers, counting machine numbers, and revenue collection and counting employees involved. A minimum discrepancy level shall be settable to eliminate minor differences.

16.5.1.6 Ad Hoc Reporting

The CDS shall provide a mechanism for authorized WMATA users to extract information directly from the NEPP database through WMATA standard report writer facilities such as, but not limited to, Crystal Reports 2008 or above release. WMATA shall be able to use any data items within the entire NEPP database to create the ad-hoc reports. In development of these reports, WMATA shall have the ability to sum columns, provide sub-totals and incorporate other functions necessary for WMATA to prepare the needed management reports.

Menus and screens to support the generation of reports, as well as the timing and location of the resulting output shall be provided.

Once a report is defined, the system shall have the ability to display the output before printing, and store the definition for reuse.

Except as approved by WMATA, system/ad hoc reports shall be generated by the report generation package provided.

16.5.1.7 System Queries

The CDS shall provide a mechanism for extracting information directly through a query facility, and shall incorporate menus and screens to support the generation of queries, as well as scheduling the location of the resulting output. Once a query is defined, the system shall have the ability to display the output before printing, and save the query procedure for reuse. All queries shall be automatically stored and shall be able to be uniquely titled by the creator of the query.

The CDS shall be capable of generating all reports and queries necessary to integrate the new system with WMATA existing applications. Queries shall be available for historical usage patterns for the NEPP System, component failures, and network reliability rates.

16.5.2 Error Messages

All software and tables shall be available for user editing through the Application Server. Updated tables for device error & event messages shall be downloaded to the devices where they will be resident.

16.5.3 Configuration Manager

The Configuration Manger shall manage the configuration of all NEPP devices and hardware. This application shall manage the addition, modification, and deletion of equipment functionality and equipment configurations utilizing a GUI menu-driven interface. This shall allow WMATA the ability to change, test configurations, and program tables before being updated throughout the system. This system shall allow the ability to roll back to a previous configuration that has not been manually purged from the system. Any difficulties with the rollback shall be automatically identified and reported to the user.

This application shall have sufficient capacity to adequately support all hardware to be provided as part of this project.

All configuration files and operational parameters of the NEPP equipment shall be managed by this application. The application shall store all necessary parameters on the NEPP database and distribute parameter and configuration changes across all NEPP networks.

16.5.4 Fare Table Manager

The Fare Table Manager shall provide menu options to create, edit, display, print, and download (to the end devices) the fare tables used to collect cash fares, to validate machine-readable Smart Media, and all other fare transactions. The “create” and “edit” functions shall be coded so that it can be executed independently and, if necessary. The fare table generation and manipulation software shall be maintained by and operated via the CDS.

The Fare Table Manager shall enable WMATA to revise and implement fare tables that are system-wide and take affect either immediately or at a pre-programmed time and date. The capability shall also be provided to create and implement a special fare that is added to or substituted for an existing fare or fare table for a temporary period (i.e., with a programmed expiration time and date) and which may apply system-wide or for a specific service (e.g., special one-day sports event service).

Completed files shall be downloaded to the NEPP Network Management Servers for distribution to NEPP field devices. Fare tables shall be identified by the date/time that they become effective.

For each of the fare tables that are retained in the NEPP database, the Fare Table Manager shall provide for a description field, allowing one to identify the purpose of that table. Additionally, the Fare Table Manager shall control and categorize fare tables by the following classification:

A. Draft – A fare table that is in development but not yet finalized or approved for deployment.

B. Approved – A finalized fare table that has not yet been assigned for deployment to the NEPP System.

C. Pending – A finalized fare table that has been assigned forthcoming dates for which it will be distributed to the NEPP System. It shall not be possible to assign a pending date to a fare table that is in conflict with either the active or another pending fare table.

D. Active – The fare table currently distributed to the system. The Fare Table Manager provide validation to ensure that only one fare table may be classified as “active”.

E. Hold – A formerly active fare table that is to be retained for revenue reconciliation. A fare table that is at Hold status shall not be capable of being modified, reassigned to a Pending status, or deleted. Manual intervention shall be necessary to release a fare table from a Hold status.

F. Expired – A fare table that has been released from a Hold status. This fare table can be modified for future use, approved as is with new pending dates assigned, or deleted.

The ability to access fare table routines and files shall be controlled through a separate layer of CDS user security.

A. For audit/security purposes, records shall be kept of all changes made to fare table components and associated files by user ID, date/time, etc.

B. At the NEPP device level, fare tables and associated files shall be tamper proof.

C. NEPP field units shall generate text, such as station names, based on information from the fare table.

D. This text shall be combined with stored images and graphics, also downloaded from the CDS, to produce the printed media.

Fare tables shall be downloaded to fare devices via the NEPP Communications Network. In the event of a network failure, the Fare Table Manager shall provide the ability to create a file for manual transfer to the fare sales devices via a secure medium.

16.5.5 Revenue Accountability System

The Revenue Accountability System shall provide all functions that are necessary to support WMATA's needs to perform oversight and auditing. This application shall allow for the inspection and review of details of all transactions related to a NEPP device, vehicle, route, garage, or station. The application shall allow the user to query this information based on a set of parameters, including time and date, locations, equipment type, equipment number, line/mode, and other parameters as agreed with WMATA at FDR. This system shall also allow for detailed transaction data to be queried based on the associated user of the system, including conductor, ticket sales agent, and cash room employee.

In addition, the application shall allow an authorized user to view the detailed transactions of a particular NEPP device in real-time.

16.5.6 Smart Media Manager

The Smart Media Manager shall provide all functions necessary for the management of WMATA smart media distribution, tracking, and fraud detection. The Smart Media Manager shall provide for the entry of serial numbers and serial number ranges into the CDS when Smart Media is received. All Smart Media entered into the CDS shall be tracked by serial number – from arrival at WMATA, through issue to a passenger and expiration/replacement/destruction of the item of Smart Media.

Inventory control of all WMATA Smart Media shall be centralized within the Smart Media Manager. This shall include Smart Media ordering and return/replacement. In addition, the Smart Media Manager shall provide functions for Smart Media initialization, hot-list management, and registration. This application shall also be the interface for tracking Smart Media usage and status by both WMATA and its passengers.

The inventory controls of the Smart Media Manager shall provide for complete inventory control of all WMATA Smart Media stocks, including stock transfers between units, as well as accounting for Smart Media inventory, including at a minimum:

A. Purchased but not issued;

B. In transit (from storage):

C. Loaded into NEPP field devices;

D. Provided to WMATA employee;

E. Issued to customer;

F. Returned by WMATA employee;

G. Consigned to third-party organization for sale;

H. Returned unsold by third-party organization;

I. Returned unused by customer;

J. Returned partially used by customer in the event of a work stoppage;

K. Refund handling for service interruptions and/or delays;

L. Issuance of reduced Smart Media; and

M. Reported lost, stolen, or destroyed.

The system shall also allow for accounting for all Smart Media sold, spoiled, jammed, slipped, or missing, to provide a comprehensive system wide audit and control function.

All records shall be identified by mode, station, equipment number, and/or location as appropriate,

Sales Support Files

The Smart Media Manager shall provide menu options to access, store, edit, display, and/or print, and download to the fare devices system files that support the sale of WMATA Smart Media. These files shall have the same security profile as the fare table files. These files may be provided to the CDS by other systems.

16.5.7 Station Manager

The Station Manager shall monitor all NEPP activities and hardware at WMATA fixed locations, such as stations. Through this application, authorized users shall be able to define and change station configuration and hardware placement. The Station Manager shall also support the change of devices at a location.

From the Station Manager, authorized users shall have the capability to remotely control all NEPP field devices. Functions that can be remotely performed by an authorized user shall include the ability to place equipment in service or out of service, reconfigure components, and perform diagnostics at both the device and component levels. In addition, users shall be able to enable / disable any payment mode or module, and transfer any information or data. All modifications to the equipment functionality shall be recorded in the CDS.

The Station Manager shall communicate with all NEPP Network Management Servers to perform all necessary administrative functions to manage their associated networks of devices.

As senior citizens and people with disabilities will be provided with WMATA-issued Smart Media to permit access to the NEPP, functionality shall be incorporated into the NEPP that provides for all Smart Media used by such passengers to be periodically verified manually at a MetroRail station by the booth agent using the Station Manager.

The periodicity of this verification shall be settable globally and for each individual Smart Media and for each Smart Media account based on the number of usages since last validation check and number of days since last validation check.

When the validation threshold is reached at the MetroRail station, then the passenger will approach the booth and present his/her Smart Media to the booth agent. Using the NEPP device within the booth the booth agent will present the Smart Media to the device and the status of the Smart Media shall be displayed to the booth agent. The information shall include as a minimum the photo stored with the account (if available) as well as the validity and usage information as necessary.

When the validity of the Smart Media is verified at the booth, the periodicity setting for the account shall be reset and the validation count shall restart anew.

16.5.8 Status Monitor

NEPP system and equipment status shall be updated and automatically maintained by the system through the Status Monitor application. The Status Monitor shall report the Real-Time status of all NEPP field devices, data networks, and all data transfers. The Contractor shall install, configure, and activate network monitoring software. To support this monitoring, the Status Monitor shall communicate with all NEPP network servers to perform all necessary administrative functions to monitor their associated functions.

The Status Monitor shall provide a graphical representation for each station, with a status of all equipment at a station. Status shall be provided in five levels of detail - station, line subsection, line, operation (Metrorail, Metrobus, etc.), and overall operation. No alarm shall automatically clear without WMATA interaction.

When a station has more than one alarm in effect, the station shall be shown in the color of the highest priority alarm.

The Status Monitor shall incorporate menu options to facilitate monitoring of each of the following:

A. NEPP unit machine status;

B. NEPP unit software status;

C. Effective date of fare tables and associated files;

D. System and unit security;

E. Network status;

F. Polling status; and

G. External system interface status (i.e., clearinghouse link).

The Status Monitor shall incorporate menus and screens supporting both the manual and automatic polling of transaction, status (receipts, change supply, media stock), and event log information. The system shall be able to designate the polling for all units of a particular type of fare device, a designated set of fare devices or individual units.

In addition, the Status Monitor shall be able to monitor connections to external telecommunications networks, and shall incorporate menus and screens to support this function.

16.6 System Monitoring & Control

The CDS shall be able to monitor the activity of the NEPP devices and the communications networks that connects and supports these devices. This shall be accomplished through the System Status application. The system shall monitor the following aspects of the NEPP System:

A. All NEPP equipment and devices outlined in Section 6 through 15.

B. The communications systems outlined in Section 15. This includes:

    1. All losses of network communications, including line drops;

    2. SNMP or equivalent diagnostics;

    3. Polling status; and

    4. Status of all CDS servers and hardware.

NEPP devices shall perform a variety of self-diagnostic functions. The CDS shall provide real time access to such status and diagnostic information. When devices register events, in both volatile and non-volatile memory, such information shall be made available to the CDS on a real-time basis. Such information shall include, but not be limited to, the devices internal software version number, fare table (effective date) in use, event description/code, etc.

This information either shall be transmitted to the CDS as part of the unit's start up procedure, or as it becomes available. Should the network connection to a device become inoperable, the information shall be transmitted to the CDS when the connection is restored. The Contractor shall provide complete technical information on the recovery from an off-line status to an on-line status.

The CDS shall retain this event data for reporting and statistical analysis. It will be used to generate historical usage patterns, unit and network "mean time between failures" rates, and reliability statistics for machine operations and network availability.

Given that most of this information will be repetitive and non-critical, the CDS shall be able to determine when active operator intervention is required. The following conditions require special handling:

A. At start up or start of any tour/start of day, the unit's internal clock setting shall be synchronized with the CDS host's internal clock based on time received from the WMATA network clock. Any significant deviation shall be addressed.

B. At start up, the unit's, software version number, the effective dates of the fare table, associated files, and media layouts shall be compared to internal CDS table(s). Any discrepancies shall generate an automatic upload of the correct information.

C. When a security breach or failure occurs, a message is sent to the appropriate WMATA department.

D. When any component in an assembly fails, the associated diagnostic messages shall be captured, stored, and transmitted to CDS in order to be made available to the WMATA department(s).

A functional description of all monitoring functions shall be provided at the Conceptual and Preliminary Design Reviews for review by WMATA and for approval by WMATA at the Final Design Review. This information shall include the design or the operational flows, screens, functions and other similar information and shall included increasing detail with each design review step. **CDRL 16-14**

16.7 Communications with NEPP Field Devices

16.7.1 Downloads to NEPP Field Devices

Manual and automatic transmission of prepared information from the CDS via the Network Management Servers, to all NEPP field devices, shall include as appropriate, but not be limited to:

A. Software upgrades;

B. System clock time;

C. Fare tables;

D. Smart media printing format updates;

E. Branches / Route;

F. Trains;

G. Buses;

H. Runs;

I. Schedules;

J. Crewman schedule;

K. Crewman employee list;

L. WMATA operational rules documentation.

The CDS shall be able to designate what will be downloaded, and to which units: All units of a particular type (e.g., all FVDs, HSDs, fareboxes, fare gates), sets of fare devices (e.g., defined by station, type of transit service or district), WMATA-defined subsets of devices, specific, selected devices and individual devices. It shall not be possible to attempt to download software to the incorrect device type.

The CDS shall provide the option of allowing control of downloads to be determined by the effective date associated with the information being downloaded. The CDS shall also provide the option of allowing control of download sets, where the control of each individual set is determined by the activation date associated with the set being downloaded.

Downloading shall not interfere with Smart Media sales or Smart Media processing functions of any NEPP devices unless the information being downloaded is required for such activities.

Whether automatically or manually initiated, system downloads shall include a method for ensuring that the information has been received intact and uncorrupted at the assembly level.

The system shall identify failed transmissions by an audible tone so that the problem can be addressed immediately. This feature may be activated or deactivated at user login.

The system shall track failed transmissions and provide diagnostic messages that include the SNMP message(s), the number of times transmission was attempted, and the assembly(s) affected. This information shall be retained for reporting, statistical analysis, audit, problem resolution, unit, and network "mean time between failures" rates.

16.7.2 Polling Field Units

The CDS shall support both the manual and automatic polling of transaction, status (receipts, change supply, Smart Media stock), and event log information. The system shall be able to designate the polling for all units of a particular type of NEPP device, a designated set of devices or individual units. These functions shall be supported by the System Status Monitor (see Section 17).

Polling shall not require shutdown of a NEPP device. Polling shall not interfere with the Smart Media selling or processing functions of the unit.

CDS software shall include options for scheduled, manually initiated, and system initiated polling.

Once every 24 hours, each NEPP device shall be polled to confirm that all units have been polled and tour data transmitted to the CDS. Transmission of 24-hour transaction data shall be based on a 24-hour period defined by WMATA (initially set as ending at 3:30am).

When polling for a NEPP device fails, there shall be two attempts to re-poll the failed unit. When polling fails, the CDS shall generate an event record and produce a printed report to notify personnel of the failure to poll, to ensure that units will either be re-polled or that their data will subsequently be read into the system from non-volatile storage media.

When NEPP devices are re-polled for any reason, or data is read from non-volatile memory, the CDS software shall insure that duplicate data is not retained within the system, or passed on to any other system.

The system shall track failed transmissions, along with Simple Network Management Protocol (SNMP) diagnostic messages, the number of times polling was attempted, and the unit(s) affected. This information shall be retained for reporting and statistical analysis. It will be used for audit and problem resolution, unit, and network "mean time between failures" rates. Contractor shall provide full information on the polling methodology, settings, and parameters.

16.7.3 Network System Assurance

The CDS shall routinely poll all wired NEPP field devices (excluding on-board and hand-held equipment) to assure that communication between CDS and device is active and secure. This polling shall occur automatically at intervals programmed by WMATA (default = 15 second intervals; range = 5 seconds – 600 seconds). If the CDS does not receive a response to its polling initiative, the CDS shall resend its request for an additional number of times that is programmable by WMATA (default = three times).

If communication is not confirmed the repeated polling by CDS, then CDS shall notify service quality and police dispatch an alarm condition, including in the alarm report the equipment, equipment type, and location. Polling time intervals and resend values shall be programmable on the following basis: entire system, device type, device type and mode, device type and station. Polling shall not interfere with sales transactions or other primary functions of the field device.

16.8 Network Security Functions

Appropriate security measures that are continuously active to prevent unauthorized intrusion to the operating system, applications, parameters, and other software modules, fully support PCI requirements and support password protection to levels prescribed by WMATA shall be implemented. The appropriate use of the AES encryption standard and other security measures appropriate for this type of system shall also be implemented.

Additional security measures, including password protection to levels prescribed, shall be included to prevent unauthorized access or modification to CDS software and associated tables. This shall incorporate the use of an Oracle® interface, which will utilize the current WMATA employee as the User ID. When the user has logged out, the User ID shall be cleared from the screen. WMATA currently uses Active Directory as the Metro standard to manage the use of WMATA employee credentials as the user ID. The Contractor may leverage Active Directory to fulfill this function. The Contractor may alternatively provide an Oracle® interface to utilize the current WMATA employee credentials as the User ID, for WMATA consideration.

Reports for system security shall be available through the security administration function. At a minimum, these reports shall provide information on employee and technician access levels, access logs for logins, central functions, maintenance activities, and all security violations or attempts.

All components of the system shall operate in a virus-free protected environment. The CDS shall have sufficient measures (software, and /or hardware) in place and active at all times to ensure that all operating systems, applications and other software operates in a virus-free environment. The Contractor shall provide, install, and maintain a fully licensed, upgradeable commercially available anti-virus software application.

The CDS shall also contain controls to prevent unauthorized access to the operating system, applications, and other software modules.

A functional description of all security functions, including virus protection, shall be provided at the Preliminary Design Reviews for review by WMATA and for approval by WMATA at the Final Design Review. This information shall include the design or the operational flows, screens, functions and other similar information and shall included increasing detail with each design review step. **CDRL 16-15**

16.8.1 System Security

The CDS security function shall provide appropriate access to all CDS functions and system data. Functional access shall, at a minimum, provide for such things as fare table and associated file maintenance, design and access of report queries, system polling, and network configuration.

CDS security functions shall be separated into the following systems:

A. Network security;

B. Data Security, which shall, at a minimum, provide for four security levels: read only, update access, create, and delete;

C. Application Security, which shall be incorporated into each application attached to the CDS and controlled at three levels:

1. Application access

2. Form access

3. Function access within form (inquire, add, change, delete).

16.8.2 Security Administration

The CDS shall support maintenance of access level tables through a security administration function. These tables shall be used to establish employee and employee group access to fare devices, Network, CDS, and data.

Reports shall be available through the security administration function. At a minimum, these reports shall provide information on employee and technician access levels, access logs for logins, critical CDS functions, maintenance activities, and all security violations or attempts.

A local system administrator shall be provided for each Regional Partner Management Server (RPMS). A different password and user name shall be required for access to system administrator functions.

A different password and user name shall not be required to access system administration functions to restrict access by application, by form and by function within form. Only administrators shall be able to get to forms that handle administration. With this, access shall be capable of being further restricted to what administrative functions can be perform, including inquire, add, change, and delete.

16.9 Media Design

The CDS shall provide “create” and “edit” functionality for Smart Media design. This functionality for creating and designing Smart Media shall be completed by WMATA staff without intervention by the Contractor. The Contractor shall satisfy this requirement through the integration of a non-proprietary, commercially available graphics software package.

The layout of all types of WMATA’s Smart Media shall be defined, edited, displayed, and saved within the CDS and downloaded to the NEPP devices. With adequate security clearance, Smart Media may be printed from the CDS for design and test purposes. When test Smart Media are produced, the word “VOID” shall be clearly visible on the Smart Media.

Smart Media layout shall allow specification of font faces, font sizes, and print density so that gray tones can be used. It is possible that Smart Media graphics will include both portrait and landscape formats, and the NEPP shall accommodate this. The software shall also allow inclusion, editing, and movement of graphics such as logos, images, OCR, bar codes, and patterns.

Layouts shall be created for each of the Smart Media sold by the NEPP devices. They will be identified as a set by the date that they become effective.

At a minimum, the software shall be able to retain the currently active Smart Media layout set, allow editing of that layout in a work area, and provide for multiple layout(s) with a future effective date for each of the defined Smart Media types.

Current and future Smart Media layouts shall be available for downloading to the NEPP devices through the network or when necessary to a file on a secured medium for manual transfer to the devices.

Expired Smart Media layouts shall be archived for future reference. Contractor shall provide detailed information on the procedures employed and the software used for the generation and storage of these Smart Media formats.

16.10 Smart Media Key Security and Key Propagation

The CDS shall incorporate necessary software security and controls to maintain, distribute, and verify the keys used throughout the NEPP for the smart media activation and usage. The necessary hardware, protocols, and software shall be incorporated within the CDS to ensure that the smart media keys can be securely stored, modified, and propagated throughout the system on an as needed basis.

An additional layer of security shall be incorporated to further ensure that only authorized access to these smart media key functions is provided.

16.11 Outsourced CDS

For the outsourced CDS, the functional and operational requirements identified within these technical specifications shall apply, except where identified within this Section 16.11. In addition, this section also includes additional requirements for the outsourced CDS.

For each item below, the appropriate section of these Technical Specifications has been identified, but these sections are not exhaustive lists and there may be additional sections affected.

A. Selection of the CDS hardware and software, including data base) shall be at the discretion of the Contractor (Sections 16.1, 16.1.1);

B. NEPP software shall be separated from software provided for others by WMATA-approved security schemes (Section 16.8.1);

C. Where servers are identified, distinct hardware need not be provided, but virtual servers may be provided; (Section 16.2.2);

D. Location of the primary instance of the CDS shall be anywhere within the continental United States (Section 16.1);

E. Data, if not contained within one physical location (such as is the case with a cloud computing methodology), shall be stored within computer systems located within the continental United States (Section 16.1);

F. Access to the CDS and the data stored shall be through the use of any device connected to the Internet with suitable browser software (Section 16.1.1);

G. No local server shall be used for operating any NEP software (Section 16.1.1);

H. Third-party software licenses need not be provided to WMATA (Section 16.1.1);

I. Architecture shall be at the discretion of the Contractor including requirements for domains, domain controllers and distinct servers (Sections 16.2.1, 16.3.3, 16.3.4.7, 16.1.1); and

J. Location of the Disaster Recovery CDS shall be at the location identified by the Contractor but shall be a minimum of seventy-five (75) miles from the Jackson Graham Building identified in Section 16.1.

For the Outsourced CDS, the functional and technical requirements for PIN Debit Encryption Processing of Section 4 shall apply and the Contractor shall propose a solution that, to the extent possible, maintains WMATA's control and ownership of the encryption key infrastructure.

16.12 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 16-1	Provide a complete description of the functionality of the CDS at each stage of the design review with the final document fully describing the operation, capabilities, and functionality of the CDS. Provide sufficient detail to permit verification that all required functions are satisfactorily included.	16.1	CDR, PDR, FDR	Yes
CDRL 16-2	Provide licenses for all third party software and core software in accordance with requirements stated in the Contract. Identify all third party software and provide WMATA a listing of all software applications and tools used within the CDS.	16.2	PDR	Yes
CDRL 16-3	Provide the overall system architecture design.	16.3	CDR, PDR	Yes
CDRL 16-4	Provide technical details and specifications on the database engine selected for the CDS.	16.3	PDR, FDR	Yes
CDRL 16-5	Provide a description of how the system performs archiving of all transaction data and critical core software to secure media without user intervention, at user	16.3	FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
	programmable time periods.			
CDRL 16-6	Provide details and information on the data redundancy scheme employed.	16.3.3	PDR, FDR	Yes
CDRL 16-7	Provide details and information on the data backup and archiving schemes employed.	16.3.4	PDR, FDR	Yes
CDRL 16-8	Provide all technical details of the process by which the primary and secondary instances of the CDS shall function and communicate to support the Disaster Recovery requirements for the CDS.	16.3.5	PDR, FDR	Yes
CDRL 16-9	Provide final design details, including server manufacture, model, and other hardware selections used with the CDS.	16.4.1	FDR	Yes
CDRL 16-10	Provide data included and format provided for the daily summary tables automatically generated from the detailed transaction detail by the CDS.	16.4.2.1	PDR, FDR	Yes
CDRL 16-11	Provide a plan for the migration of all WMATA historical data from WMATA's existing legacy and business systems to the CDS.	16.4.2.7	PDR	Yes
CDRL 16-12	Provide a plan for time synchronization of all NEPP field devices with the CDS as set by the Domain Controller.	16.4.4	PDR	Yes
CDRL 16-13	Provide the general design of input forms for all information to be entered by system users.	16.5.1	PDR	Yes
CDRL 16-14	Provide a functional description of all monitoring functions provided by the CDS. This information shall include the design or the operational flows, screens, functions and other similar information and shall included increasing detail with each design review step.	16.6	CDR, PDR, FDR	Yes
CDRL 16-15	Provide a functional description of all security functions, including virus protection. This information shall include the design or the operational flows, screens, functions and other similar information and shall included increasing detail with each design review step.	16.8	PDR, FDR	Yes

End of Section 16

Section 17 – System Interfaces and APIs
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17 SYSTEM INTERFACES AND APIS

The New Electronic Payments Program (NEPP) shall incorporate open payment methods using multiple technologies in an open architecture. The NEPP shall utilize Application Program Interfaces (APIs) developed by the Contractor for, and controlled by, WMATA.

To provide for an open system, the NEPP shall incorporate new and/or upgraded fare collection and verification equipment as well as a new Central Data System (CDS).

17.1 NEPP Data Warehouse and Business Analytics

WMATA and the Regional Partners require the ability to use NEPP and other business systems data for a variety of business intelligence purposes including, but not limited to, strategic planning and route analysis. NEPP data shall be combined with other legacy AFC data, route schedules, customer surveys, on-time performance data, as well as non-agency data such as demographics, weather, economic data, etc. The solution shall funnel data from legacy/business systems and the NEPP through a single consolidated data source so that a number of benefits may be attained.

The Contractor shall provide advanced analytical tools that enable WMATA users to perform enhanced analyses that will drive better decision making, planning, operational efficiency, etc., by leveraging the additional data collected and consolidated from the NEPP and related WMATA systems.

The Contractor shall provide a commercial off-the-shelf WMATA-approved Business Intelligence Analytics software package, which shall be compatible with WMATA's existing Data Warehouse (see Section 17.2.1.4). All NEPP data shall be made available for access and use by the Business Intelligence Analytics software. The Contractor shall provide all additional components required to provide infrastructure and control services, security and audit controls, as well as operational support and administration services.

The Contractor shall provide a new NEPP Data Warehouse that will store NEPP and data from all business systems as identified in this Section 17 with which the CDS shall interface.

The Data Warehouse shall store all relevant usage, payment and equipment tracking/maintenance data, in addition to data from other systems. The solution shall be fast, cost effective to administer, easily configurable, user friendly, and based on open architecture principles. The Data Warehouse shall automatically receive production data on a recurring basis throughout each day.

The following is a description of the key solution components of the NEPP Data Warehouse:

- Access to the reporting, dashboard, analytic, and any administrative capabilities provided through the web and also through remote integration with desktop software.
- Allow upload or download of datasets through, at a minimum, an Oracle direct database link.
- Allow ability to acquire third party data sets through, at a minimum, an Oracle direct database link or email.
- All data utilized by the analytics solution must ensure maximum data integrity.
- Data management infrastructure, control, and log services to minimize the support and operational costs.
- Metadata services that includes at least the capability to describe all data in easy to understand business terms.
- Reporting, dashboard, and analytic capabilities able to access the data in near-real-time on sales, ridership, system performance and equipment availability, in addition to data from other business systems.
- Security and audit services to ensure that users are only able to access data and capabilities that they are authorized to have. Data must be auditable and stored and processed in accordance with all applicable financial industry rules, guidelines and regulations, as well as support compliance with all applicable laws.
- A comprehensive dashboard software application shall provide for a near-real time view of the WMATA system, including trends, reporting, etc. Dashboard software shall be flexible to support customized views for each user or group of users.

A comprehensive business recovery plan shall be included as part of the Data Warehouse design, including secure redundancy of data.

A commercially available package is required, with easy-to-use self-service tools for users in addition to additional tools for administrative and “power” users.

The Data Warehouse shall use industry best practices for design and utilize only standard, non-proprietary instructions, procedures, and commands.

An Interface Control Document (ICD) of all datasets for the warehouse shall be developed during Design Reviews. The ICD shall include but not be limited to all applicable data elements to support customer service and claims, business intelligence, auditing, reconciliation, risk management, device management and monitoring, settlement and all other data required by WMATA.

The ICD shall become the property of WMATA when implemented for the NEPP. However, it is understood that for an ongoing implementation, the Contractor may need to modify the ICD. Prior to any implementation of a modification, a revised ICD shall be provided to WMATA. Identification and definition of the ICD shall be provided at the Conceptual Design Review for review by and discussion with WMATA. **CDRL 17-1**

The ICD shall become the property of WMATA at the conclusion of each implementation phase at which time the software escrow shall be updated. For each implementation phase, the Contractor shall modify the ICD as needed for the implementation of the next phase. One complete ICD shall be provided to WMATA at the completion of each phase in addition to the copy provided to the software escrow. **CDRL 17-2**

Data shall be stored and easily retrievable for a period in accordance with applicable WMATA records retention policies, with older data archived automatically. Archived data shall be easily retrievable.

17.2 System Interfaces

The NEPP CDS shall interface with a number of present systems and software to obtain data from and supply data to these systems. Contractor shall provide interfaces to existing systems to facilitate the transfer of data to and from the existing systems and the CDS. These systems include, but are not limited to, a general ledger to record revenue, an automated process for billing, accounts receivable, cash management (some automation to banks), and deal management as identified below and in see Figure 17-1:

- PeopleSoft;
- Trapeze;
- Maximo;
- Data Warehouse; and
- Transit Database.

For each interface, the CDS shall incorporate menus and screens to support transfer of information to and from each business and legacy system. Interfaces with these systems shall be in the form of APIs, as described in Section 17.3 below. In addition, the Contractor shall develop a procedure and all necessary software tools to interface with the business and legacy system data and file structures.

The contractor shall supply methods to report on all the interfaces that transfer information to and from each business and legacy system. This reporting shall include a dashboard to view the number and types of records transferred as well as a GUI interface to track exceptions, correct exceptions and submit the correcected records for re-processing. Additionally the contractor shall supply a mechanism to notify WMATA staff of any exceptions in the process via email and SMS.

Descriptions of all business and legacy system interfaces shall be provided at the Conceptual Design Review for review by and discussion with WMATA. **CDRL 17-3** Full information for System Interfaces shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-4**

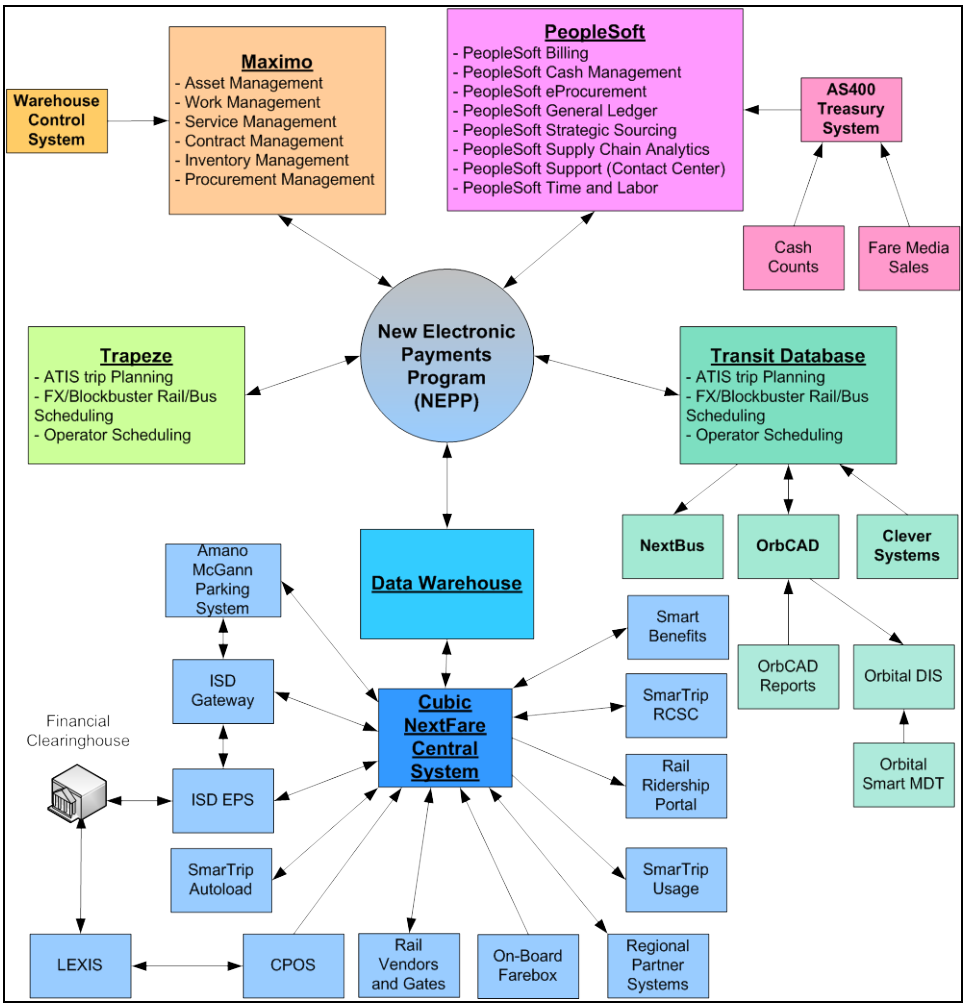

Figure 17-1 - New Electronic Payments Program (NEPP) System Interfaces

17.2.1 Interfaces with WMATA Business and Legacy Systems

The NEPP CDS shall interface with WMATA's business and legacy systems, applications, and databases as defined in the following sub-sections. Figure 17-2 illustrates this integration and interfacing between WMATA NextFare 5 legacy systems, WMATA's business systems and the NEPP.

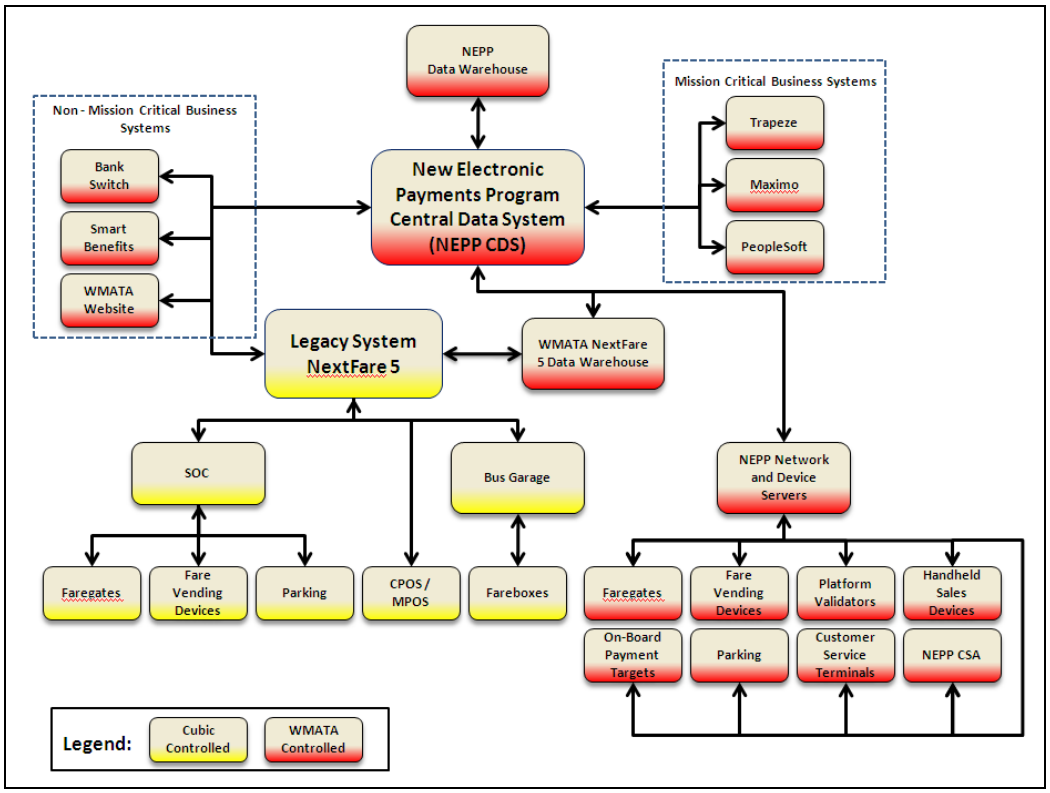

Figure 17-2 – New Electronic Payments Program (NEPP) Integrated with WMATA Business and Legacy Systems

17.2.1.1 PeopleSoft

WMATA utilizes various PeopleSoft Enterprise Resource Planning modules. Several PeopleSoft modules are used in an Automatic Fare Collection (AFC) capacity and it is anticipated that WMATA will continue to integrate various PeopleSoft modules to assist in the day-to-day execution and operation of AFC business processes. Table 17-1 lists the PeopleSoft modules currently utilized in conjunction with AFC applications.

PeopleSoft Module	Module Description
PeopleSoft - Asset Management	PeopleSoft Financial Management module for managing financial details of assets, such as depreciation, retiring and acquisition planning.
PeopleSoft – Billing	PeopleSoft Financial Management module for creating invoices and managing bills. This is used in the management of WMATA's Smart Benefit Program.
PeopleSoft - Cash Management	PeopleSoft Financial Management module for monitoring and forecasting cash requirements, performing automated bank reconciliations, distributing payments efficiently and securely, and automatically generating accounting entries. This module is used in managing credit card billing and bank statement management.
PeopleSoft - eProcurement	PeopleSoft module for management and ordering of fare media inventory.
PeopleSoft - General Ledger	PeopleSoft Financial Management module that provides legal and managerial financial reporting.
PeopleSoft - Strategic Sourcing	Allows for online negotiation and collaboration to bring down procurement costs of goods and services. This module ties into the PeopleSoft eProcurement module for the management of fare media inventory.
PeopleSoft - Support (Contact Center)	Customer Relationship Management (CRM)
PeopleSoft - Support for Customer Self Service	Self-service component of Customer Relationship Management (CRM)

Table 17-1 - PeopleSoft Module Descriptions

The CDS shall interface with WMATA's PeopleSoft modules to facilitate the transfer of data from the existing system to the NEPP CDS.

17.2.1.2 Trapeze

WMATA uses three Trapeze modules:

- Trapeze Automated Transit Information System (ATIS) is used to support Metrobus, Metrorail, and MetroAccess trip planning by customer service representatives as well as directly by customers using the online trip planner;
- Trapeze FX/Blockbuster is used to manage Metrobus and Metrorail scheduling; and

- Trapeze OPS is used to assign operators to blocks and generate pay data. Blocks are obtained from Trapeze FX/Blockbuster and assignments are forwarded to OrbCAD.

The CDS shall interface with all Trapeze modules described to import data provided by each module.

17.2.1.3 Maximo

Maximo is used to facilitate the asset and work management process. Table 17-2 lists the various management modules present within Maximo.

Maximo Module	Module Description
Asset Management	Asset Management provides the control needed in order to more efficiently track and manage asset location data throughout the asset life cycle. It provides methods to: • Track asset detail; • Establish location and asset hierarchies; • Monitor asset and location conditions; • Support both conventional and linear assets.
Work Management	Work Management provides the tools to manage both planned and unplanned maintenance activities, from initial work request and work order generation through completion and recording of actuals. The tool allows work planners to match job tasks to available resources, estimate and obtain approval of costs, establish priorities, and initiate maintenance activities across the enterprise.
Service Management	Service Management allows the end user to submit new service requests, as well as to track and update open service requests.
Contract Management	This integrated contract management system provides enhanced control over your vendor contracts. Comprehensive contract management support will be provided for purchase, lease, rental, warranty, labor rate, software, master, blanket and user-defined contracts.
Inventory Management	Inventory Management provides knowledge of the details—what, when, where, how many, how valuable—about asset-related inventory and its usage. Inventory management functionality records material movements and adjustments, allowing for real-time inventory tracking, reporting and auditing. The module also allows embedded images of an asset to be displayed in the catalog search.
Procurement Management	The Procurement Management module supports the phases of enterprise-wide procurement, including direct purchasing and inventory replenishment. Buyers can be provided with more extensive requisition, quotation, vendor, purchase order and contract capabilities, thereby allowing them to plan work more proactively.

Table 17-2 - Maximo Module Descriptions

The CDS shall interface with Maximo for the management of all NEPP devices and equipment.

17.2.1.4 Data Warehouse

The WMATA Data Warehouse stores summarized data imported from the NextFare 5 Central System. The Cubic NextFare 5 Central System includes several databases for the various components of WMATA's existing fare collection system in conjunction with application servers. Legacy WMATA applications that interface with the NextFare 5 Central System include:

- Amano McGann Professional Access Control for parking equipment management;
- ISD Gateway and ISD Enterprise Payment Switch (EPS);
- Smart Benefits;
- SmarTrip Autoload;
- SmarTrip Usage;
- Customer Point-of-Sale (CPOS);
- Rail Vendors and Gates;
- On-Board Farebox (Bus);
- WMATA Regional Partner Fare Collection Systems;
- Rail Ridership and Statistics Portal for near real time ridership statistics; and
- SmarTrip® Regional Customer Service Center (RCSC).

The CDS shall not interface directly with the NextFare 5 Central System. The CDS shall interface with the WMATA Data Warehouse to import WMATA-selected data obtained from the NextFare 5 Central System.

The WMATA Data Warehouse includes data tables that provide end users with fact and dimension data for the purposes of reporting and reconciliation. The complete data structure of the WMATA Data Warehouse is appended to these Technical Specifications as Exhibit 17.1. Exhibit 17.1 includes all Data Marts developed for access by the WMATA Functional/Business Areas, the reporting functions available within each Data Mart, and the Report Attribute short names available within each Reporting Function.

In conjunction with the Cubic NextFare 5 Central System data imported into the WMATA Data Warehouse, WMATA end users also find it useful to query fact and dimension data detail from within the NextFare 5 Central System for reporting and reconciliation functions. Exhibit 17.2 includes NextFare 5 fact and dimension data tables which are commonly utilized by WMATA end users for reporting transactional detail.

Figure 17-3 illustrates the flow of data between the NextFare 5 Central System databases and the WMATA Data Warehouse.

End users of the WMATA Data Warehouse use the following applications for data queries and data reporting:

- Crystal Reports
- Discoverer Reports

The CDS shall provide the capability for these reporting tools to be used to query the system database and produce the reports currently produced by WMATA end users. The reporting tools identified above shall be capable of being used to query the CDS to provide end users with the query and reporting capabilities currently provided for the WMATA Data Warehouse.

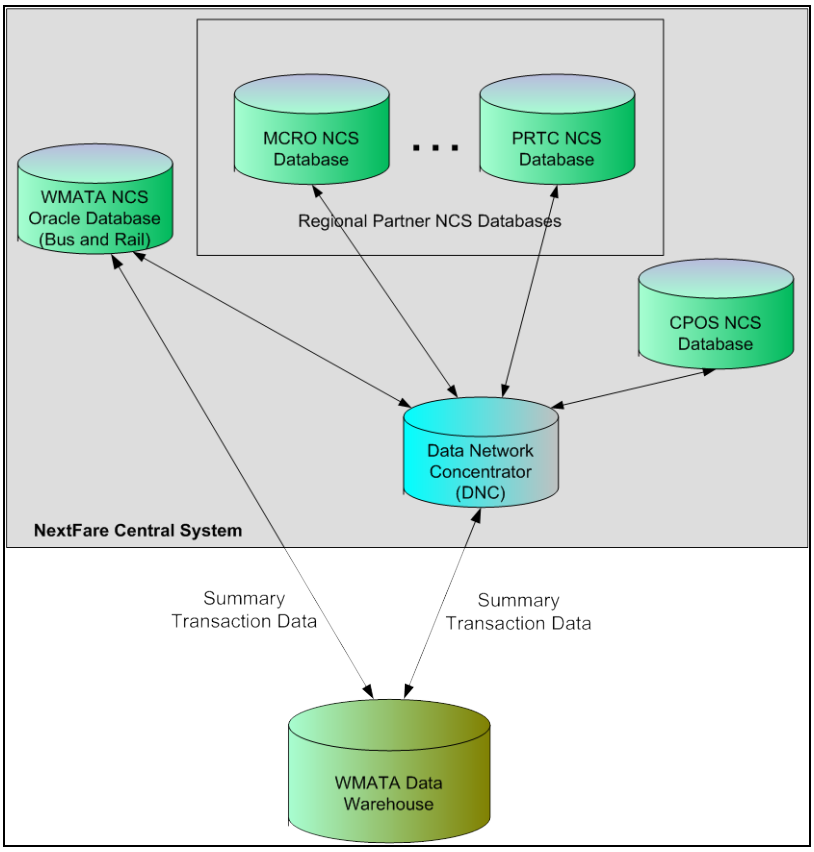

Figure 17-3 - Data Flow between Cubic NCS Databases and WMATA Data Warehouse

17.2.1.5 Transit Database

The WMATA Transit Database interfaces with various WMATA applications for Bus and Rail including, but not limited to, Transit Center, Vehicle, Field, and Traveler) Support. Applications that interface with the Transit Database include, but are not limited to:

- Clever Devices
    - Bus Tools;
    - Portable Data Probes;
    - Buslink/Automatic Vehicle Maintenance System;
    - Intelligent Vehicle Network;
    - Bus Stat/APC/AVM data;
- OrbCAD Suite

    - OrbCAD Automatic Vehicle Location System;
    - Orbital Data Integration Server
    - Orbital Smart Mobile Data Terminal;
    - Real Time Nextbus data feed;
- Nextbus
    - Real time data feed;
- Trapeze Suite (as identified in Section 17.2.1.2)
    - Operator Assignment;
    - Geo Schedulees, bus stop, map data;
    - Schedule;
    - Feed Employee emgercy contact;
    - RSA data;
    - APC data;
- Peoplesoft
    - Employee;
- Cubic Nextfare
    - Smartip Cardholder;
    - Fare Table;
    - Employee ID data;
- Maximo
    - Vehicle inventory;
    - Maintenance workorder creation;
    - Vehicle Maintenance data.

The CDS shall interface with the WMATA Transit Database to import data stored within the Transit Database.

17.2.2 External System Interfaces

Access to the CDS shall be limited through security and appropriate user password authorization. Every interface with the CDS shall contain safeguards (software and/or hardware) to prevent unauthorized intrusion as well as access to and modification of data.

17.2.2.1 Interface with WMATA WAN

To allow authorized users to access the reporting and management applications available on the NEPP Application Server, the NEPP Application Server shall be accessible from the WMATA WAN. However, the CDS shall be protected from unauthorized access on the WMATA WAN. To support this, the Application Sever shall be connected to WMATA's WAN via a WMATA-approved hardware firewall. The firewall shall examine all network traffic and block any transmissions that do not meet defined security criteria.

Additionally, the firewall shall record all events and transmit them via a system log service to external WMATA server for permanent storage.

17.2.2.2 WMATA Network and Workstations

The CDS shall interface with WMATA's existing WAN (Section 15) and all workstations that are connected to it. These terminals shall allow authorized employees access to defined system functions, including all applications on the NEPP Application Server, through the CDS security functions.

The connection between the CDS and WMATA's WAN shall occur through the NEPP Application Server. This server shall incorporate dual network card interfaces, and will serve as the bridge between the two data networks. All user interaction from the WMATA WAN shall be through the NEPP Application Server and its associated applications. Users from WMATA's WAN shall not be able to communicate with any other CDS server without going through the Application Server.

All commands and data access from the WMATA WAN shall be recorded for audit purposes; such recording shall not affect CDS operations.

17.2.2.3 Alarms to WMATA Police Dispatch

The CDS shall immediately record all alarm conditions, and WMATA-identified alarms shall be immediately communicated by the CDS to WMATA's Transit Police force. Alarms forwarded to this system shall include unauthorized entry into any NEPP field device and failure of a field device to respond to a system assurance poll by CDS. A list of alarm conditions to transmit to WMATA's Transit Police force shall be developed for Final Design Review. **CDRL 17-5** This list shall be able to be modified by WMATA without Contractor intervention.

Data forwarded to the Transit Police shall be in the format specified by WMATA for that system's ready acceptance, processing and distribution. The format of the data feed requirements for WMATA's police force will be provided to the Contractor by WMATA at the Preliminary Design Review.

17.2.2.4 Communications with Financial Institutions

The CDS shall provide for communication with financial institutions (banks and/or clearinghouses) for the purposes of obtaining authorization to complete a transaction with a credit card or debit card, or to load value to a NEPP Transit Account linked to a financial account.

The communications with the Financial Institutions shall meet the reliability requirements of Section 16.

All communications with financial institutions shall be ISO/IEC 8583 compliant. All communications network components and devices shall comply with the Payment Card Industry Data Security Standard (PCI DSS) and utilize End-to-End encryption.

The ability for WMATA to add, change, and delete financial institutions shall be incorporated within the NEPP.

The NEPP shall support the logging, storage, backup, and retrieval of information regarding such data transmissions, including timing of the transmission, data transmitted, and status of the transmission, for both individual transactions and entire files, such as settlement files.

The CDS shall automatically accept files transmitted to WMATA, from such institutions, including, but not limited to, bank settlement files, reconciliation files, bank identification number files, and other necessary files.

17.3 Application Program Interfaces

The Contractor shall develop and publish System APIs for the NEPP to enable equipment provided by any certified supplier to integrate with the CDS. The Contractor shall also provide APIs for interfaces with third-party software, such as the Third-Party Mobile Parking Payment software, provided as part of the NEPP, and for existing WMATA Business and Legacy Systems. The APIs shall provide for a comprehensive, operational NEPP and ensure that fare collection devices from multiple, certified suppliers successfully integrate and operate as part of the NEPP.

The CDS shall include a series of Application Programming Interfaces (APIs). These APIs shall enable WMATA to develop customized interfaces between the NEPP and other applications/systems, including the applications identified in Section 16.

In addition to APIs for payment processing, fare verification, Customer authorization to transit services for WMATA and the Regional Partners, a complete set of APIs shall be provided for the NEPP to permit the CDS to provide for a single point for data entry, control, reporting and other similar functions to provide a truly integrated system. APIs to permit proper operation of the CDS for the functions as identified in Section 16 shall be provided. Examples of such functions include, but are not limited to, the following:

- Data Reporting;
- System and Equipment Configuration;
- Fare Table Management;
- Remote Control;
- Revenue Accountability;
- Smart Media Management
- Facility/Station Management; and
- Status Monitoring

APIs shall become the property of WMATA when implemented for the NEPP. However, it is understood that for an ongoing implementation, the Contractor may need to modify APIs. Prior to any implementation of a revised API, a complete set of APIs shall be provided to WMATA. Identification and definition of all APIs shall be provided at the Conceptual Design Review for review by and discussion with WMATA. **CDRL 17-6**

All APIs shall become the property of WMATA at the conclusion of each implementation phase at which time the software escrow shall be updated. For each implementation phase, the Contractor shall modify the APIs as needed for the implementation of the next phase. One complete set of APIs and source code for each API shall be provided to WMATA at the completion of each phase in addition to the copy provided to the software escrow. **CDRL 17-7** APIs developed and provided by the Contactor shall include, but not be limited to, the following information:

- Message definitions;
- Encryption methodologies;
- Tokenization of credit and debit card numbers (if included in the NEPP);
- Transaction record definitions;
- Message formats;
- Transaction record formats;
- Defined transaction field codes;
- Operational rules;
- System resources;
- Libraries;
- Operational routines;
- Object classes;
- Protocols; and

- All other information needed to fully and successfully communicate with and provide proper data transfer with the third-party/supplier equipment and the NEPP CDS.

To the greatest extent possible, Smart Media usage and payment messages used by the APIs shall be or shall be based on the version of ISO/IEC 8583-1 messages approved at the time of the Conceptual Design Review.

Until the completion of the NEPP implementation, as identified in Section 19,missing APIs will be identified by WMATA and shall be implemented by the Contractor before final system acceptance.

Full description of all APIs and their constituent elements shall be developed and provided for WMATA review and approval at the Preliminary Design Review. **CDRL 17-8** Full design information shall be provided at the Final Design Review and approved by WMATA after review to ensure that the all WMATA needs are met. **CDRL 17-9**

17.3.1 API Certification

The Contractor shall be responsible for providing detailed processes and procedures to WMATA for review at PDR and approval at FDR to permit certification of other companies/suppliers to enable additional equipment and software to be deployed as part of the NEPP. **CDRL 17-10** These processes and procedures shall become property of WMATA when the APIs become property of WMATA.

Until Final System Acceptance, the Contractor shall be responsible for the certification of such companies/suppliers.

17.3.2 API Verification

An independent, third party firm shall verify all APIs prior to the commencement of First Article Testing; third-party verification shall also occur after all releases of new functionality, when the Contractor determines that a complete set of APIs has been issued. WMATA will identify the firm to be used for this verification and will be responsible for their costs for the initial software release and for all releases of new functionality.

Should additional verifications be necessary for the APIs due to errors and omissions, then the Contractor shall be responsible for those costs of verification by the WMATA-identified independent, third party firm.

17.4 End User System Interfaces and Data Flows

WMATA's organization consists of various Functional Areas, with each consisting of several Departments. A number of these Functional Areas and their associated Departments interface with WMATA's AFC systems and shall be required to interface with the NEPP to support their operations. These Functional Areas and associated Departments are defined within Section 17.4 of the Technical Specification. The Contractor shall ensure that these Functional Areas and Departments are capable of interfacing with the NEPP CDS to support their functionality and reporting requirements.

17.4.1 Operations

17.4.1.1 Metrorail Operations

Metrorail Operations utilizes Trapeze to support Metrorail Operations and Scheduling Business Flow. The Metrorail Scheduling Business flow is illustrated in Figure 17-4. The interface between Trapeze and the CDS shall support all Metrorail Business Flow functions and data exchange (see Section 17.2.1.2).

Metrorail Operations utilizes the WMATA Data Warehouse to fulfill all current reporting requirements (see Exhibit 17.1 WMATA Data Warehouse Data Structure). Metrorail Operation end users shall be capable of producing all standard and ad-hoc reports currently generated using the Data Warehouse, via the NEPP CDS. End users shall be able to utilize the same reporting tools and applications currently used to query the WMATA Data Warehouse.

Full definitions of system interfaces and all data flows required to support Metrorail Operations within the CDS shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-11**

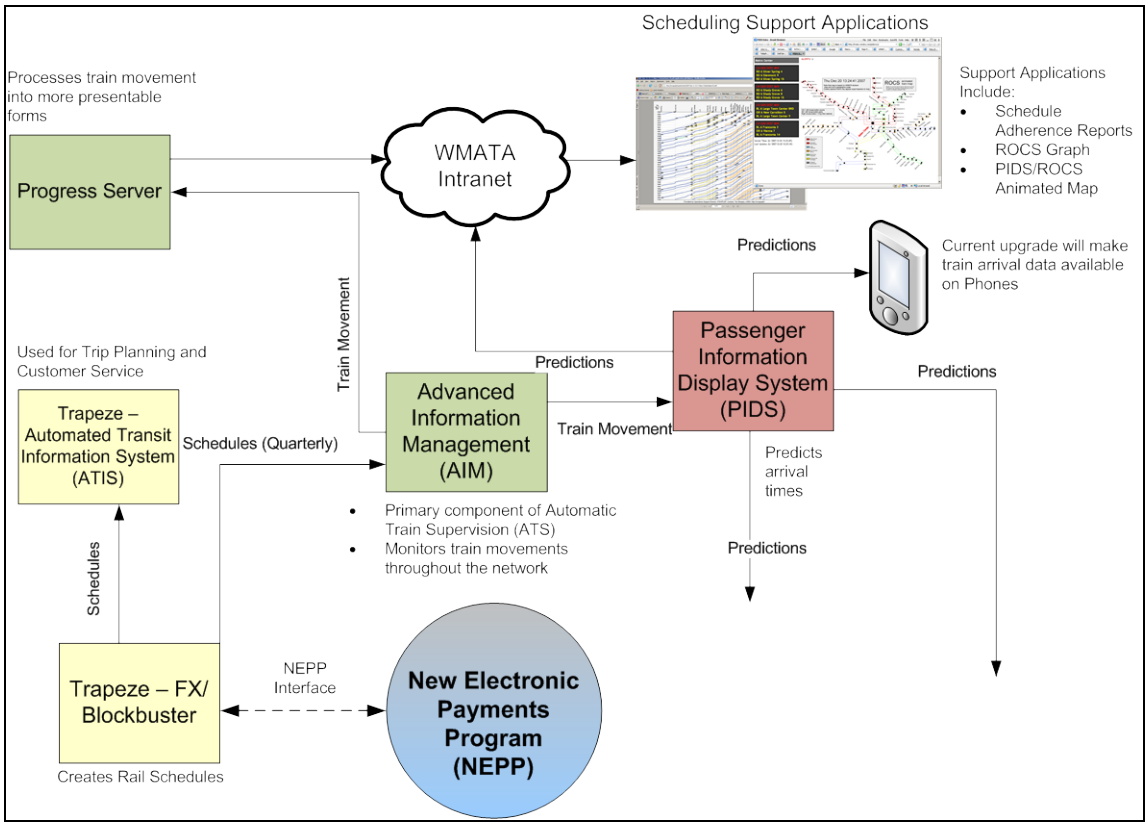

Figure 17-4 - Metrorail Scheduling Business Flow

17.4.1.2 Metrobus Operations

Metrobus Operations utilizes Trapeze to support the Metrobus Operations and Scheduling Business Flow. The Metrobus Operations Business flow is shown in Figure 17-5. The interface between Trapeze and the CDS shall support all Metrobus Business Flow functions and data exchange (see Section 17.2.1.2), the WMATA Data Warehouse and the CDS (see Section 17.2.1.4), and the Transit Database and the CDS (see Section 17.2.1.5).

Metrobus Operations utilizes the WMATA Data Warehouse to fulfill all existing reporting requirements (see Exhibit 17.1 WMATA Data Warehouse Data Structure). Metrobus Operation end users shall be capable of producing all standard and ad-hoc reports currently generated using the Data Warehouse, via the NEPP CDS. End users shall be able to utilize the same reporting tools and applications currently used to query the WMATA Data Warehouse.

Full definitions of system interfaces and all data flows required to support Metrobus Operations within the CDS shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-12**

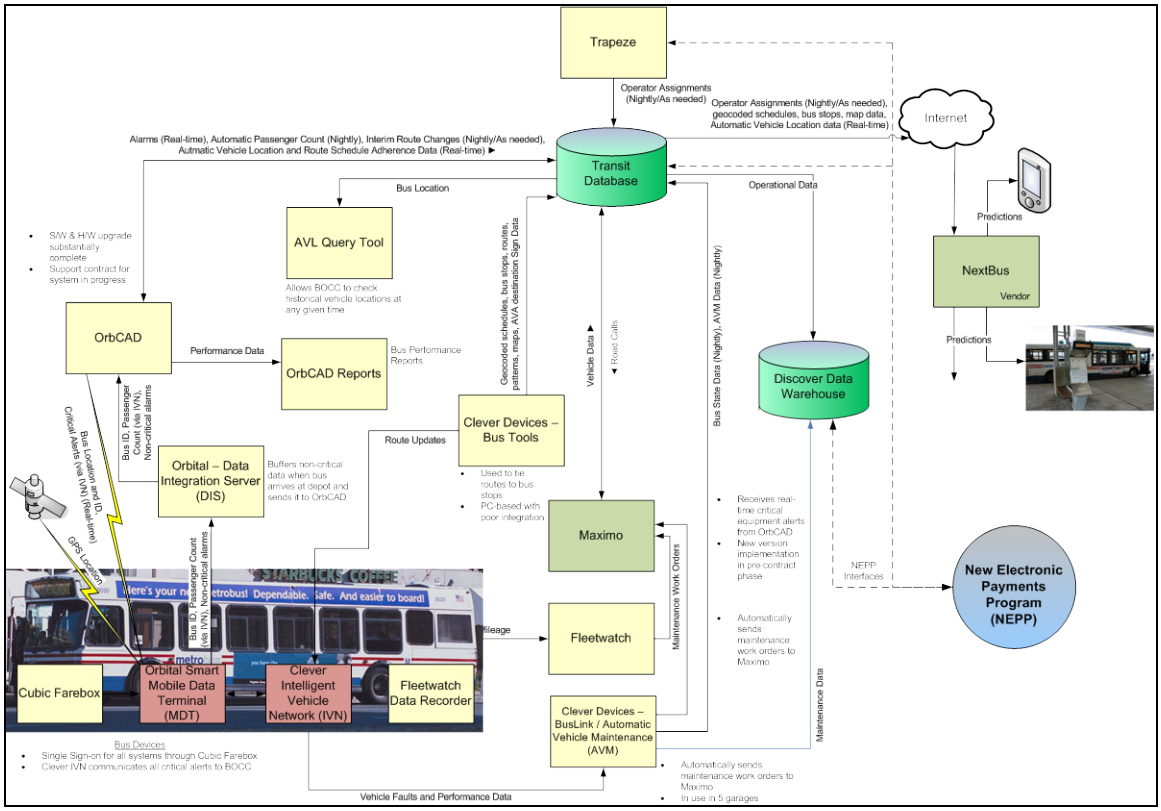

Figure 17-5 - Metrobus Operations Business Flow

17.4.1.3 Parking Operations

Parking Operations utilizes the WMATA Data Warehouse and the Parking Management Database to support all reporting and reconciliation activities. Data Warehouse provides all paid transaction activity including daily lane counts and revenue per day per lane and station. The Parking Management Database Shall continue to be supported by the Amano McGann Professional Access Control system which supplies data to the Cubic NCS. The Parking Operations data flow is shown in Figure 17-6.

Parking Operation end users shall be capable of producing all standard and ad-hoc reports currently generated using the Data Warehouse, via the NEPP CDS. End users shall be able to utilize the same reporting tools and applications currently used to query the WMATA Data Warehouse. The Contractor shall develop all software necessary to support these requirements.

Full definitions of system interfaces and all data flows required to support Parking Operations within the CDS shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-13**

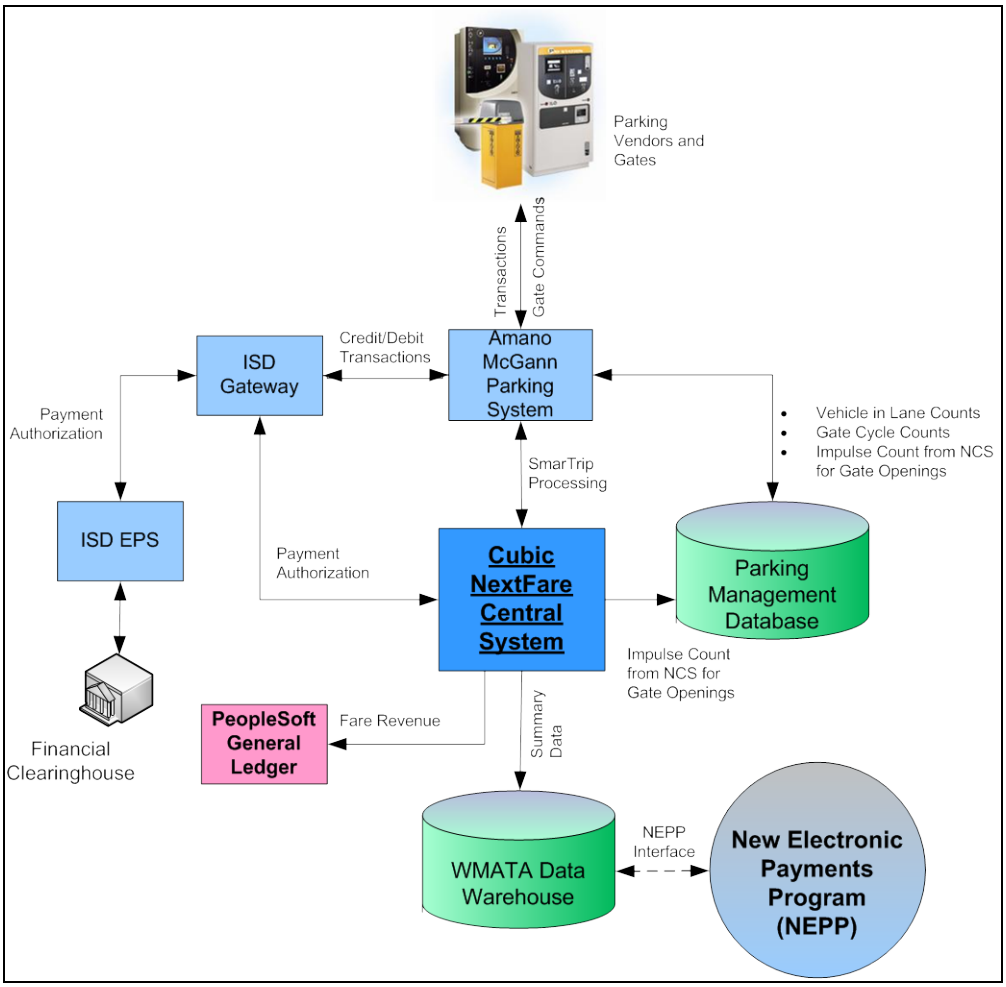

Figure 17-6 - Parking Operations Data Flow

17.4.1.4 MetroAccess Operations

MetroAccess utilizes the EZ-Pay System that is a Trapeze PASS pre-paid fare Paratransit application. EZ-Pay utilizes a Trapeze PASS Database, external to any WMATA AFC Systems, applications, and databases. Trapeze PASS supports MetroAccess' maintenance of customer accounts and balances, scheduling of trip bookings, employee and vehicle dispatch, and the management of billing at the time of trip scheduling. The Trapeze PASS Database stores all data associated with the EZ-Pay system.

The Contractor shall develop all software and necessary tools to allow the NEPP CDS to interface with the EZ-Pay Trapeze PASS System and Database to enable NEPP accepted smart media to be utilized to access MetroAccess EZ-Pay accounts for replenishment of accounts and trip bookings, and for the payment of MetroAccess fares.

Full definitions of system interfaces and all data flows required to support MetroAccess Operations within the CDS shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-14**

NEPP MetroAccess Operations end users shall be capable of producing all standard and ad-hoc reports currently generated using SQL queries against the Trapeze PASS Database. End users shall be able to utilize the same reporting tools and applications currently used to query the MetroAccess Trapeze PASS Database. The Contractor shall develop all software necessary to support these requirements.

MetroAccess utilizes the WMATA Data Warehouse to support the reporting of ridership data for MetroAccess customers who are eligible to utilize WMATA fixed route modes. The data structure of the MetroAccess Data Mart is shown in Exhibit 17.1- WMATA Data Warehouse Data Structure. NEPP MetroAccess Operations end users shall be capable of producing all standard and ad-hoc reports currently generated using the Data Warehouse, via the NEPP CDS. End users shall be able to utilize the same reporting tools and applications currently used to query the Data Warehouse. The Contractor shall develop all software necessary to support these requirements.

17.4.2 Maintenance

The Maximo Asset Management System is used to facilitate WMATA's asset and work management process. WMATA's Asset Management Business Flow is shown in Figure 17-7. Full definitions of system interfaces and all data flows required to support the Maximo Asset Management interface with the CDS shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-15**

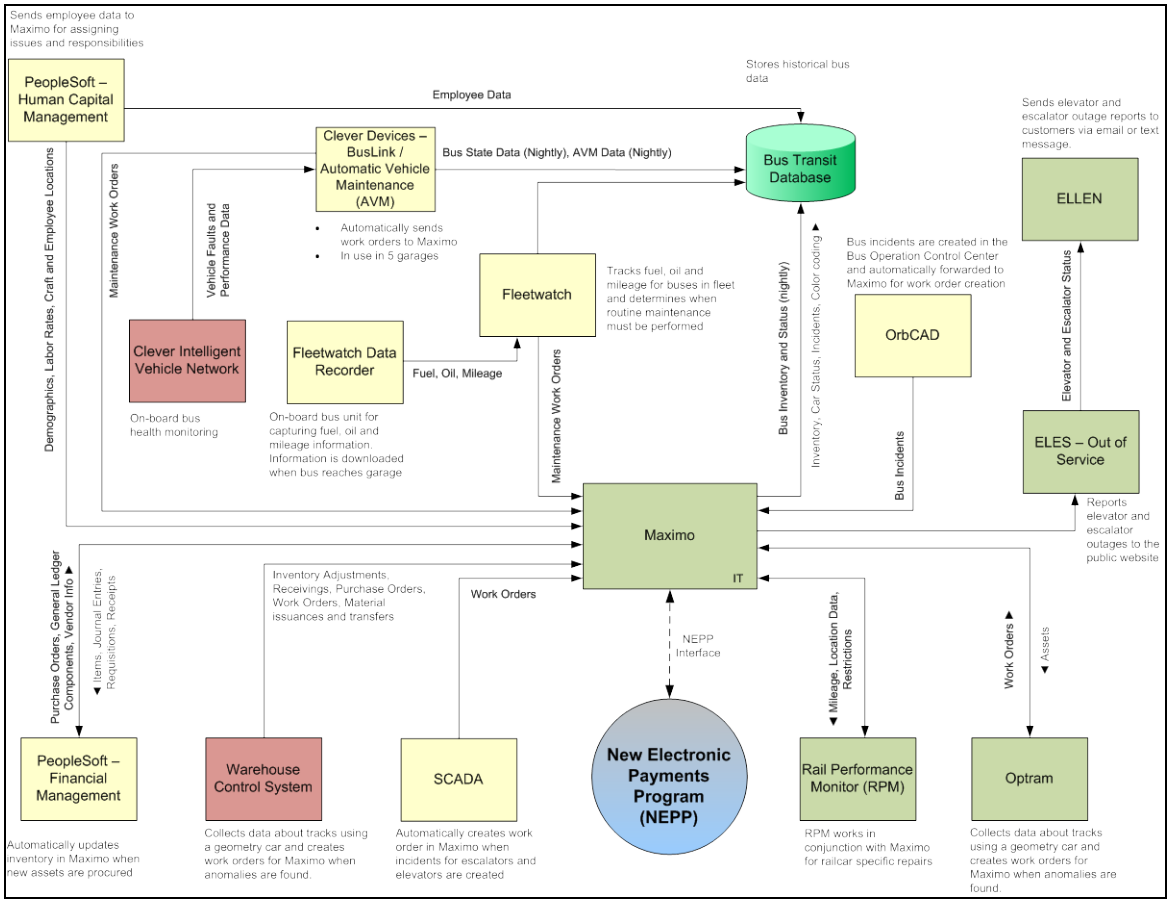

Figure 17-7 - Asset Management Business Flow

17.4.2.1 AFC Rail/Parking Maintenance

AFC Rail/Parking Maintenance utilizes the Maximo Asset Management System to support Preventative and Corrective Maintenance scheduling via the Rail Performance Monitor. The Maximo Report Server supports AFC Rail/Parking Maintenance in providing information such as vehicle and equipment historical repair data. AFC Rail/Parking Maintenance also utilizes the Cubic NCS to access Rail/Parking AFC data such as bus AFC device data and event histories.

The Contractor shall be develop all software and necessary tools to allow the NEPP CDS to interface with the Maximo Asset Management System (see Section 17.2.1.3) for Rail/Parking NEPP equipment Preventative and Corrective Maintenance scheduling in Maximo using transactional and usage data received from the NEPP.

17.4.2.2 AFC Bus Maintenance

AFC Bus Maintenance utilizes the Maximo Asset Management System to support Preventative and Corrective Maintenance scheduling via Fleetwatch. The Maximo Report Server supports AFC Bus Maintenance in providing information such as bus data, and bus historical repair data. AFC Bus Maintenance also utilizes the Cubic NCS to access Bus AFC data such as bus farebox data and event history.

The Contractor shall develop all software and necessary tools to allow the NEPP CDS to interface with the Maximo Asset Management System (see Section 17.2.1.3) to allow Bus NEPP equipment Preventative and Corrective Maintenance activities to be scheduled in Maximo using transactional and usage data received from the NEPP.

17.4.3 Revenue Management

17.4.3.1 Treasury Sales and Fare Media

Treasury Sales and Media utilizes the AS400 Mainframe Consignment Control System to support fare media and Customer Point-of-Sale (CPOS) management. Fare media sales volume data is automatically reported to the AS400 System. CPOS sales volume is manually reported to the AS400 System.

The Contractor shall develop all software and necessary tools to allow the NEPP CDS to interface with the PeopleSoft Cash Management Application to support fare media and Customer Point-of-Sale (CPOS) management. Full definitions of system interfaces and the data flows to support Treasury Sales and Fare Media Operations within the CDS shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-16**

17.4.3.2 Treasury Revenue

Treasury Revenue utilizes the AS400 Mainframe Consignment Control System to support the reporting of all revenue data from the Cubic NCS, WMATA Data Warehouse, ISD Electronic Payment System (EPS), and Vendor Sales Locations. The AS400 interfaces with PeopleSoft Cash Management to provide this Revenue data to PeopleSoft. Revenue from Fare Media Sales and Bulk Fare Media sales are reported directly to PeopleSoft Account Receivables and PeopleSoft Billing, respectively which are amalgamated into PeopleSoft Cash Management along with revenue from Consumer Refunds via PeopleSoft Account Payables.

The data flow for Treasury Sales and Fare Media, and Treasury Revenue is shown in Figure 17-8. The Contractor shall develop all software and necessary tools to allow the NEPP CDS to interface with the PeopleSoft Cash Management Application (see Section 17.2.1.1).

Full definitions of system interfaces and all data flows required to support Treasury Revenue within the CDS shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-17**

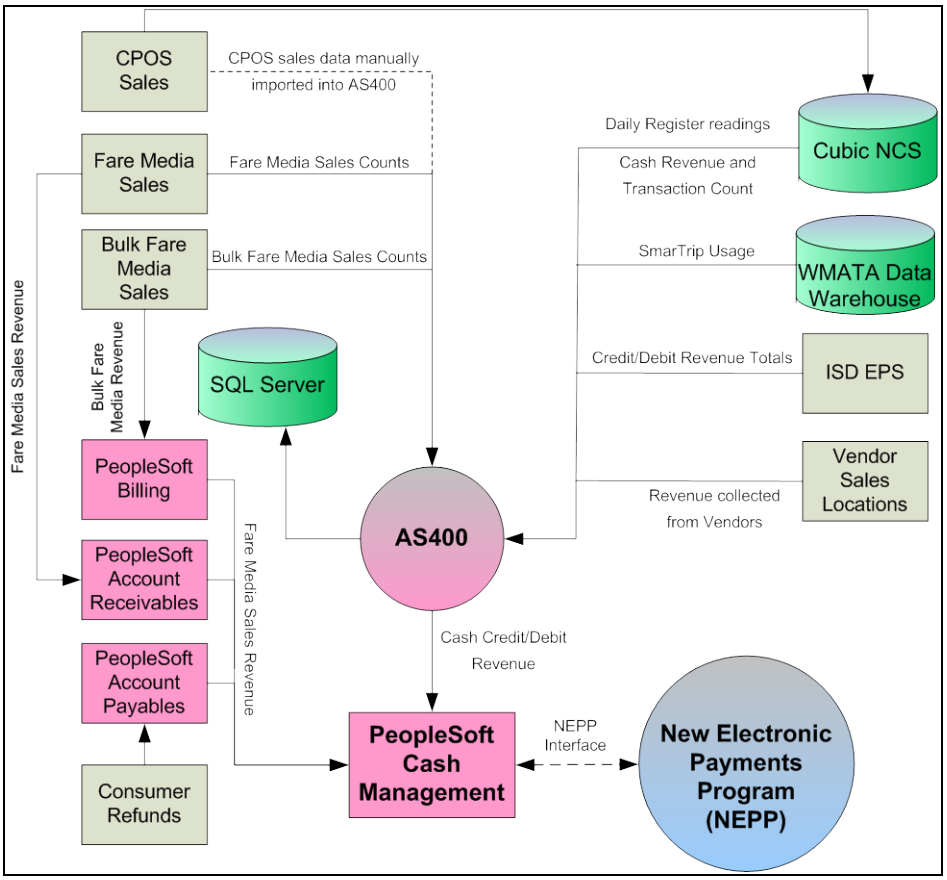

Figure 17-8 - Treasury Sales and Fare Media, and Treasury Revenue Data Flow

17.4.3.3 Accounting

WMATA Revenue Accounting and Reporting end users utilize prepared reports from selected Functional Areas and Departments and interface directly with others to perform re-classification of Revenues collected into appropriate Revenue source classifications. Table 17-17-3 provides the list of method of reporting for each Department reconciled by Accounts.

Table 17-17-3 - Method of Reporting to Accounting per Applicable WMATA Department

Department	Report Method	Description
OMBS	Prepared Report	Fares extracted from Gate Report (Rail usage report)
BUS BPLN Operations Planning	Prepared Report	Fares collected with SmarTrip card report for reclassification Bus revenue
Parking	Prepared Report	SmarTrip parking report utilized for reclassification of parking surcharge from SmarTrip cards
TRES/RCF	System Interface	Bus, Rail, Parking, DC Circulator, coin and currency Revenue reports generated directly
TRES/RCF	System Interface	Pass, tokens, fare cards, etc. fare media revenue reports generated directly
MetroAccess	Prepared Report	Differential revenue between MV Transportation Monthly contractual fee and revenue collected reported as prepared report.

The Contractor shall not be required to develop any interfaces to support Accounts reporting functions with the NEPP.

17.4.4 Revenue Ridership and Data Reporting

17.4.4.1 Budget

Budget reports revenue collected on a monthly basis for Metrorail and Metrobus. Budget utilizes Discoverer to query the WMATA Data Warehouse to produce a range of ad-hoc reports as needed by end users. Budget also uses Discoverer to query Cubic's NCS to generate standard reports as needed by end users. The Budget Revenue Reporting data flow is shown in Figure 17-9.

The Contractor shall develop all software and necessary tools to allow the NEPP CDS to interface with the WMATA Data Warehouse (see Section 17.2.1.4). Budget end users shall be capable of producing all ad-hoc reports currently generated using the Data Warehouse, via the NEPP CDS. End users shall be able to utilize the same reporting tools and applications currently used to query the WMATA Data Warehouse. The Contractor shall not be required to provide an interface between the CDS and the Cubic NCS. End users shall continue to utilize the existing reporting tools and applications to generate of the standard reports obtained using Cubic NCS.

Full definitions of system interfaces and all data flows required to support Budget Operations within the CDS shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-18**

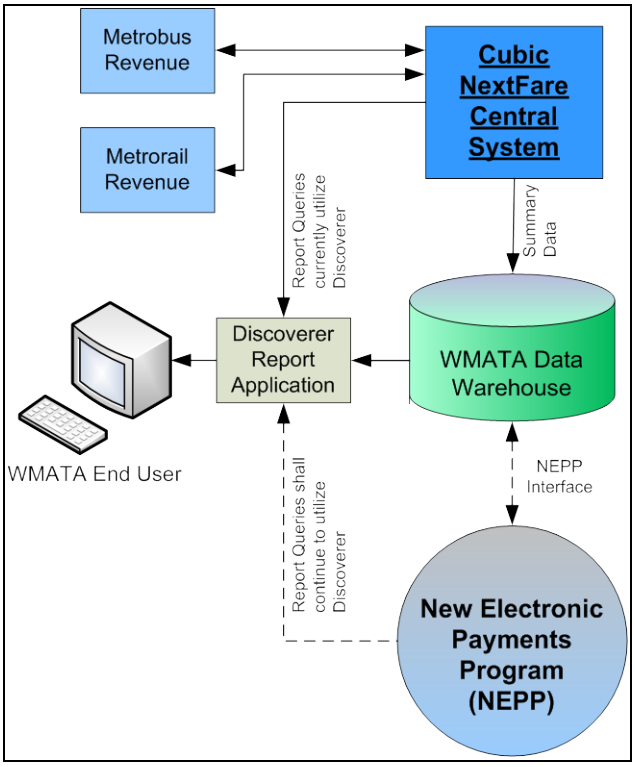

Figure 17-9 - Budget Revenue Reporting Data Flow

17.4.4.2 Operations Planning and Support

Operations Planning and Support reports ridership statistics on a monthly basis for MetroRail and Metrobus. Full definitions of system interfaces and all data flows required to support all elements of Operations Planning and Support within the CDS shall be provided for WMATA review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 17-19**

17.4.4.3 Metrorail

Operations Planning and Support for Metrorail utilizes InfoView and the NCS Portal System to query Cubic's NCS for the generation of daily ridership statistics and reports. Figure 17-10 shows a sample of the Ridership Report produced on a monthly basis.

Run Date = 3/1/2011
Run Time = 11:42:57AM

Washington Metropolitan Area Transit Authority
Ridership Report(Station New)
Period: 2/28/2011 - 2/28/2011

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MEZZ	MEZZ NAME	AFCE		AM PEAK	AM OFF	PM PEAK	PM OFF	TOTAL	EXIT+ENTRY
92	ADDISON ROAD	6	EXIT	376	547	1949	481	3353	
			ENTRY	2145	695	341	107	3288	6641
85	ANACOSTIA, N	7	EXIT	39	84	512	86	721	
			ENTRY	540	147	58	3	748	1469
106	ANACOSTIA, S	8	EXIT	1527	1495	2424	739	6185	
			ENTRY	2447	1798	1369	340	5954	12139
	STATION TOTAL	15	EXIT	1566	1579	2936	825	6906	
			ENTRY	2987	1945	1427	343	6702	13608
81	ARCHIVES-NAVY MEMORIAL	7	EXIT	5374	1775	772	105	8026	
			ENTRY	511	1321	5517	764	8113	16139
42	ARLINGTON CEMETERY	9	EXIT	72	326	50	0	448	
			ENTRY	9	272	136	0	417	865
99	BALLSTON	11	EXIT	3823	1717	4367	1510	11417	
			ENTRY	4739	1806	3913	771	11229	22646
90	BENNING ROAD	5	EXIT	289	493	1123	418	2323	
			ENTRY	1458	719	402	136	2715	5038
12	BETHESDA	9	EXIT	3238	1656	3398	1426	9718	
			ENTRY	3644	1699	3340	882	9565	19283
47	BRADDOCK ROAD	5	EXIT	688	482	2479	954	4603	
			ENTRY	2710	674	798	163	4345	8948
89	BRANCH AVENUE	9	EXIT	563	93777	4064	763	99167	
			ENTRY	4744	748	507	170	6169	105336
27	BROOKLAND	7	EXIT	2001	1581	2136	661	6379	
			ENTRY	1941	1462	2182	691	6276	12655

Figure 17-10 - Metrorail Ridership Report Sample

It is anticipated that all data queried from the Cubic NCS to produce the Ridership Report shown shall be incorporated into the Data Warehouse. The Operations Planning and Support for Metrorail data flow and reporting is shown in Figure 17-11.

The Contractor shall develop all software and necessary tools to allow the NEPP CDS to interface with the WMATA Data Warehouse (see Section 17.2.1.4). Operations Planning and Support for Metrorail end users shall be capable of producing all standard and ad-hoc reports currently utilized, via the NEPP CDS.

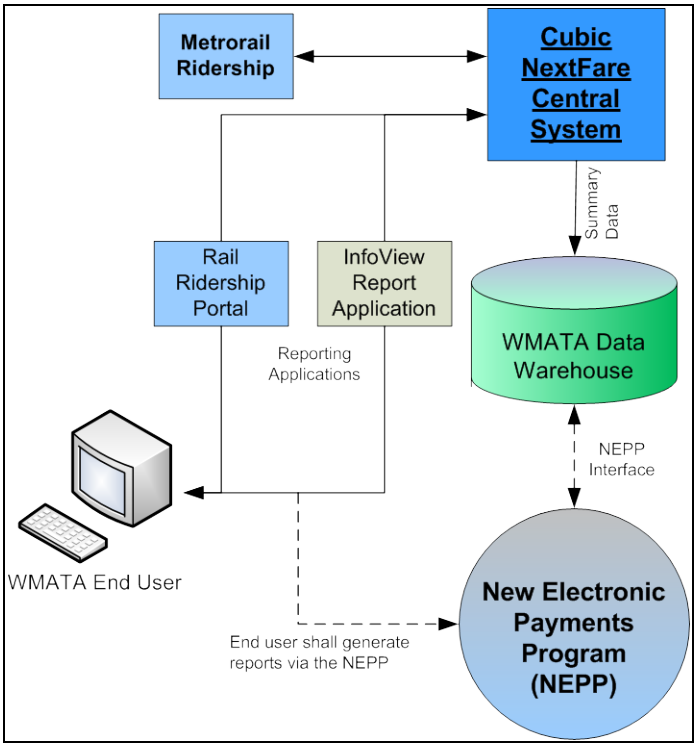

Figure 17-11 - Operations Planning and Support for Metrorail Data Flow

17.4.4.4 Metrobus

Operations Planning and Support for Metrobus utilizes the WMATA Data Warehouse to fulfill all current reporting requirements (see Exhibit 17.1 WMATA Data Warehouse Data Structure). The Operations Planning and Support for Metrobus data flow and reporting is shown in Figure 17-12.

The Contractor shall develop all software and necessary tools to allow the NEPP CDS to interface with the WMATA Data Warehouse (see Section 17.2.1.4). Operations Planning and Support for Metrobus end users shall be capable of producing all standard and ad-hoc reports currently generated using the Data Warehouse, via the NEPP CDS. End users shall be able to utilize the same reporting tools and applications currently used to query the WMATA Data Warehouse.

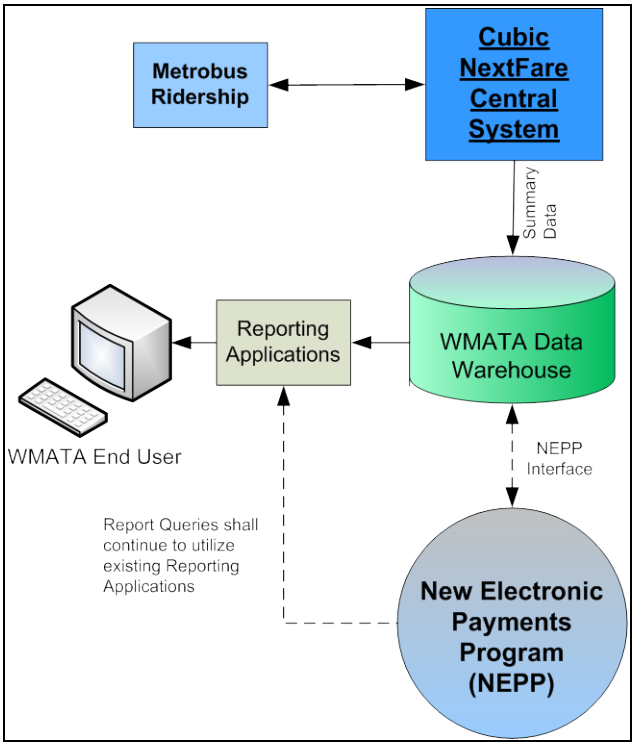

Figure 17-12 - Operations Planning and Support for Metrobus Data Flow

17.4.4.5 Executive Steering Committee for KPIs

The Executive Steering Committee for KPIs utilizes a number of reports prepared by WMATA Functional Areas and Departments to determine KPIs. The KPIs utilized to determine how Metro is performing do not include AFC data.

The Contractor shall not be required to develop an interface to support reporting of KPI parameters from the NEPP.

17.5 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 17-1	Provide description and details of the Interface Control Document (ICD)	17.1	CDR	Yes
CDRL 17-2	Provide a complete ICD at the completion of each phase and a copy to the software escrow.	17.1	Completion of each project Phase; Software Escrow	Yes

CDRL No.	Description	Section	Due	Approval Required
CDRL 17-3	Provide descriptions of all business and legacy system interfaces for the NEPP.	17.2	CDR	Yes
CDRL 17-4	Provide full information for System Interfaces of business and legacy system interfaces for the NEPP.	17.2	PDR, FDR	Yes
CDRL 17-5	Provide an initial list of alarm conditions to be transmitted to WMATA's Transit Police force.	17.2.2.3	FDR	Yes
CDRL 17-6	Provide identification and definition of all NEPP System APIs to be developed.	17.3	CDR	Yes
CDRL 17-7	Provide one (1) complete set of APIs to WMATA	17.3	Completion of each project Phase; Software Escrow	Yes
CDRL 17-8	Provide full description of all NEPP APIs.	17.3	FDR	Yes
CDRL 17-9	Provide full design information of all NEPP System APIs and their constituent elements.	17.3	FDR	Yes
CDRL 17-10	Provide detailed processes and procedures to WMATA to permit certification of other companies/suppliers	17.3.1	PDR, FDR	Yes
CDRL 17-11	Provide full definitions of system interfaces and all data flows required to support Metrorail Operations within the CDS.	17.4.1.1	PDR, FDR	Yes
CDRL 17-12	Provide full definitions of system interfaces and all data flows required to support Metrobus Operations within the CDS.	17.4.1.2	PDR, FDR	Yes
CDRL 17-13	Provide full definitions of system interfaces and all data flows required to support Parking Operations within the CDS.	17.4.1.3	PDR, FDR	Yes
CDRL 17-14	Provide full definitions of system interfaces and all data flows required to support MetroAccess Operations within the CDS.	17.4.1.4	PDR, FDR	Yes
CDRL 17-15	Provide full definitions of system interfaces and all data flows required to support the Maximo Asset Management interface with the CDS.	17.4.2	PDR, FDR	Yes
CDRL 17-16	Provide full definitions of system interfaces and all data flows required to support Treasury Sales and Fare Media Operations within the CDS.	17.4.3.1	PDR, FDR	Yes
CDRL 17-17	Provide full definitions of system interfaces and all data flows required to support Treasury Revenue Operations within the CDS.	17.4.3.2	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
CDRL 17-18	Provide full definitions of system interfaces and all data flows required to support Budget Operations within the CDS.	17.4.4.1	PDR, FDR	Yes
CDRL 17-19	Provide full definitions of system interfaces and all data flows required to support all elements of Operations Planning and Support within the CDS.	17.4.4.2	PDR, FDR	Yes

End of Section 17

Section 18 – Program Management
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18 PROGRAM MANAGEMENT

18.1 General

This Section specifies the requirements for contract management. The management shall be sufficiently comprehensive to enable The Washington Metropolitan Area Transit Authority (WMATA) to ascertain, with a high degree of confidence, that the Contractor will meet the requirements of this Specification, and to enable WMATA to monitor the contractual effort.

The Contractor shall establish an organization to properly manage the New Electronic Payments Program (NEPP) design, manufacturing, implementation, 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 provide and maintain a secure, on-line document review website to manage and maintain copies of all project documentation, reviews, correspondence, and submittals. This website shall be accessible by authorized WMATA project staff. 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.

18.1.1 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, subcontractor equipment procurements, construction, test, and inspection of systems similar to the NEPP.

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. No substitution of the Project Manager will be permitted without WMATA's prior approval.

The Contractor shall establish a project office in the WMATA service area and within one-eighth of a mile from a Metro station. The office shall open within 30 days of award of contract and remain open until completion of the warranty period. The local office shall be staffed during normal business hours on all days WMATA administrative offices are open for normal business. The Project Manager shall be based in the Contractor's local office.

The Project Manager shall represent the Contractor during progress meetings, design review meetings, warranty, 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 NEPP 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 weekly 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.

18.1.2 Management Plan

Within 30 days of NTP, the Contractor shall submit a Management Plan to WMATA for approval. **CDRL 18-1** 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 NEPP 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 description of the process and on-line document control tools to track and control project correspondence.

D. 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.

E. WMATA requires that the Contractor develop an updated and complete Contract Deliverables Requirement List (CDRL) based on the requirements identified in each Section of this Technical Specification. The CDRL shall contain the consolidated listing of all required data including specific format, quantity, frequency, and paragraph reference of submittal as required by the Technical Specification. 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 acceptance 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.

18.1.3 Submittal Review Prioritization Plan

To expedite the design review and approval process, the Contractor shall develop a comprehensive plan for prioritizing the review of submittals in cooperation with WMATA. For this reason, the Contractor shall schedule a series of meetings with WMATA within two weeks of submittal of the Management Plan to develop the Submittal Review Prioritization Plan ("Review Plan"). This plan shall be based on the Drawing Schedule and CDRL submitted in the Management Plan, and shall include drawings at levels of indenture below that of those in the Drawing Schedule. The Submittal Review Prioritization Plan, once agreed to, shall become part of the Management Plan. Subsequent updates to the Review Plan shall be ongoing as required to meet the needs of the Program.

The Review Plan shall group submittals into categories based on their criticality to various phases of the program. Suggested submittal groupings are as follows:

- Advance submittals which must be reviewed and approved (informally, at least) early in the program to allow further design work to proceed. These should be key conceptual design submittals that define basic device and system configurations and demonstrate Specification compliance at the component and system levels.
- Submittals which must be reviewed and approved prior to the start of procurement activities.
- Submittals which must be reviewed and approved prior to the start of manufacturing.
- Submittals which must be reviewed and approved prior to first article inspection.
- Submittals which must be reviewed and approved prior to the start of equipment testing.
- Submittals which must be reviewed and approved prior to delivery of the first device of each type.
- Submittals for which review and approval may be deferred to some point after delivery of the first device.
- As-built submittals.

- Submittals for information only (i.e., formal review and approval is not required).

In some cases, drawings may be scheduled for completion at an early stage in the program that do not require review until a later stage, depending on the agreed-upon criticality of those drawings to the overall design. WMATA approval of the Submittal Prioritization Review Plan and the agreed-upon deferral of review and approval for a given submittal does not in any way relieve the Contractor from compliance with the Specification, or from the responsibility to produce a satisfactory design. Items not reviewed are not exempt from the requirements of the contract. Any items which are proposed as alternatives to the contract requirements shall be submitted to WMATA for review and approval prior to the start of procurement, whether identified as such in the original Review Plan or not.

The Review Plan shall also include a description of review program logistics, particularly those aspects of the program that supplement the traditional submittal and review process to accelerate design review and approval. These may include provisions for co-residence of cognizant Contractor and WMATA personnel to expedite turnaround of submittals, non-binding up-front reviews that are contingent on ultimate receipt of supporting drawings, in-process design reviews convened as needed, and any other methods for expediting review that are deemed appropriate by the Contractor and WMATA.

18.1.4 Risk Management Plan

Within 30 days of NTP, the Contractor shall submit a Risk Management Plan to WMATA for approval. **CDRL 18-2** The purpose of the Risk Management Plan is to identify and mange 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 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.

18.1.5 Master Program Schedule

Within 30 days of NTP, the Contractor shall submit for WMATA's review and approval a Master Program Schedule in accordance with the requirements of the Contract. **CDRL 18-3**

The Master Program Schedule shall cover all phases of the work and 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 the NEPP. 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 status of each type of equipment and Central Data System (CDS) item in the NEPP.

E. Sufficient detail shall be provided for the analysis, design, build, test, and implementation of each of the applications on the application server. Work details shall include, but not be limited to, review of legacy applications being replaced, gap analysis, data conversion plan, interface plan, integration plan, development milestones, milestone reviews, test plan, implementation plan and post-production support.

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.

18.1.6 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 18-4**

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. Updates to the Risk Management Plan showing existing or anticipated problems or issues, and the proposed work-around to address the issue;

C. Updated CDRL list, including current status of all deliverables;

D. Updated Submittal List and Schedule, including current status of all submittals;

E. Updated action item log showing current status of all action items as defined in Paragraph 18.1.7;

F. Updated Correspondence Log showing all project correspondence and anticipated response dates for open items of correspondence as defined in 18.1.8;

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.

18.1.7 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.

18.1.8 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 the web-based document control system, and available to authorized WMATA project team members.

18.1.9 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 and overall NEPP system design, configuration, and layout;

C. WMATA and Contractor to review intended operations and maintenance requirements;

D. WMATA and Contractor to identify interface requirements between WMATA and Contractor, especially regarding communications and installation interfaces;

E. Contractor to identify initial information and decisions required from WMATA; and

F. Contractor to identify any requirements for which waivers will be requested.

18.1.10 Progress Review Meetings

Progress Review Meetings (PRMs) shall be held at least twice each month, at the offices of WMATA or the Contractor as selected by 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. **CDRL 18-5** The Contractor's Project Manager shall attend and chair these meetings.

As a minimum, the following topics shall be discussed:

- Introduce new attendees and areas of responsibility;
- Review minutes of previous meetings, amend minutes if necessary, and accept minutes;
- Review of the updated Master Program Schedule;

- Analyze work accomplished since previous meetings, including: design status, fabrication problems, product delivery problems, device installation problems, schedule slippages, problems arising from proposed changes, and other circumstances which might affect progress of the work;
- Discuss sequence of critical work and schedule of manufacturing using the Master Program Schedule and Monthly Progress Reports;
- Discuss engineering, manufacturing, and quality control;
- Discuss changed conditions and time extensions;
- Discuss corrective measures to maintain Progress Schedule when necessary; and
- Discuss work to be done in the next six weeks.

Each of the inquiries, reports, and requests for solution of problems presented during such meetings shall be answered, when possible, during the meeting; those not answered during the meeting shall be solved and the resolution documented and delivered in person or mailed to WMATA, within three working days of the close of the meeting, or longer time frame if mutually acceptable. Project Review meeting minutes shall be prepared by the Contractor and submitted to WMATA for review and approval.

18.1.11 Contractor Representatives

The Contractor, and its subcontractors, shall provide qualified technical and administrative support on WMATA's property commencing with the arrival of the first device and concluding with the completion of the warranty program. The Contractor Representatives shall be fluent in English and fully qualified for the on-site tasks. Included among the personnel shall be a full range of engineering skills, until such time as all devices are accepted. All necessary specialized Contractor and subcontractor support shall be available, on short notice, to assist the on-site personnel in the investigation and resolution of device and system malfunctions.

Contractor Representatives must be identified by the Contractor and display appropriate identification while on WMATA property. The Contractor's on-site personnel must undergo WMATA's safety training prior to access to WMATA facilities and adhere to all WMATA Rules and Regulations.

18.2 CONTRACTOR'S QUALITY ASSURANCE PROGRAM

18.2.1 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 Quality Assurance/Quality Control 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.

18.2.2 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 18-6** 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.

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.

18.2.3 Quality Assurance

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:

- Contract Review
- Document Control
- Procurement
- Shop Fabrication
- Field Fabrication
- Field Installation
- Field Assembly
- Receiving Inspections
- Final Inspection
- Software Controls
- Factory and Field Testing
- Handling and Storage
- Packaging and Shipping
- Quality Records
- Non Conformance Reporting
- Corrective Action (s)
- QA Audits
- Training
- Control of In Process Activities
- System 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.

18.2.4 Source Quality Control

Regarding source quality control, the Contractor shall:

A. Document that each manufactured product and fabricated item is produced and tested to comply with highest quality standards. The Contractor shall perform required audits to maintain level of quality.

B. Document all software and system controls utilized during the analysis, design, build, test, and implementation of the NEPP including the CDS.

C. Not deliver material, manufactured product or fabricated item until certified quality assurance documents are satisfactorily reviewed by WMATA.

D. Not schedule any factory tests/inspections by WMATA until these documents are satisfactorily reviewed by WMATA. Twenty-one (21) day's prior written notice is mandatory for (re) scheduling any factory tests/inspections by WMATA.

WMATA reserves the right to source inspect the manufactured product or fabricated item after acceptance of the certified quality assurance documents. Any and all costs related to re-inspection(s) by WMATA shall be the responsibility of the Contractor.

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.

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

18.2.5 Site Quality Control

The Contractor shall identify an individual (CQC) within its organization for this Project, who shall be responsible for overall management of the Contractor's QA/QC system. The CQC shall meet the following requirements:

A. The CQC shall be experienced in the performance and supervision of the inspections and tests required by the specifications. The CQC shall be local to the WMATA service area at all times that work is taking place and have complete authority to take any action necessary to ensure conformance with the Contract. The CQC will be the point-of-contact for all quality matters. The CQC is expected to represent the Contractor with respect to all QA audit and review activities performed on the Contractor by outside parties. The CQC shall be appointed by letter.

B. The CQC shall be responsible for the documented incoming inspection and determination of acceptability in conformance with Contract requirements of all material arriving at site. Receiving inspection(s) shall include the review of associated documentation where necessary to verify the compliance of the item. Segregate and remove from the site, any nonconforming and/or damaged material.

C. No work shall be performed at the site if the Contractor's Superintendent or his authorized representative, as approved by WMATA, is not present at the location where work is being performed.

18.2.6 Software Source Code Version Verification

As part of the overall QA program after delivery or escrow of the NEPP system software, at any time desired, WMATA will have the capability to ascertain the versions of the software source code supplied and to verify these versions against those installed in the equipment in service. This version control shall be provided as specified in Section 2.

All software source code shall be provided (i.e. delivered to WMATA or placed in escrow in accordance with the requirements of the Contract). Provided software shall consist of:

- Contractor developed software, object code, source code with comments, and documentation, together with all Contractor developed programming tools, text editors, compilers, and supporting materials necessary for providing an executable version of the software.

- Programming contained in ROMs, PROMs and for firmware.

- Also included shall be any utilities developed or off the shelf programs used to trouble shoot the software and or hardware.

In addition, third-party software and supporting materials necessary for providing an executable version of the software shall also be provided to WMATA. Each time that any version is revised, the provided software source code shall be updated accordingly.

All provided software source code shall be available for verification each time there is a modification to the software by the Contactor. When this software is accessed by WMATA, verification of the source code and tools shall be performed at the discretion of WMATA.

Using the source code and all uninstalled and unmodified third party software and software tools, and following the directions provided by the Contractor, WMATA shall generate the executable code software. Each software module shall generate and provide the proper version information when the executables are generated.

The Contractor shall provide all procedures and processes for the creation of the software modules from the source code to the executables, and for the checking and verification of the versions of each of the software modules against the version of software deployed in the field on NEPP devices. This information shall be provided at the Final Design Review for WMATA review and approval. **CDRL 18-7**

18.2.7 WMATA Quality Assurance

WMATA may, at its discretion, perform its own QA monitoring of work done under this Contract, including monitoring of the Contractor's or subcontractor's QA activities. Such activities shall not reduce or alter the Contractor's QA responsibilities, nor reduce or alter the Contractor's obligation to meet the requirements of this document, including the schedule requirements.

After NTP, WMATA or its designee will have the right of free access to facilities of the Contractor and subcontractors. This right will permit WMATA to inspect, examine, and test items during manufacture and prior to shipment. On demand, the Contractor's Quality Assurance Plan, procedures, and records shall be made available to WMATA for inspection and audit. In addition, copies of all drawings, diagrams, schedules, changes, and deviations shall be made available promptly upon request.

If requested, the Contractor shall provide to WMATA a temperature-controlled and adequately lighted private office at the Contractor's manufacturing facility to accommodate a minimum of two people, and shall have access to toilet facilities. A telephone and access to the Internet shall be made available for WMATA's use.

18.3 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. **CDRL 18-8, CDRL 18-9**

Various submittals required for each stage of the design review process, with many submittals required at more than one of the design reviews. When a submittal is required for more than one design review stage, the following are the expected completion percentages of that submittal:

- When required for two (2) design reviews, the completion percentage for the first design review is 85%, and 100% for the second.
- When required for three (3) design reviews, the completion percentage for the first design review is 50%, 85% for the second and 100% for the third.

Documents, drawings, and data to be furnished by the Contractor for approval by WMATA shall include all information conveyed for the design review meetings, as described herein, including their completed, final form and all other submittals described in this Contract. WMATA reserves the right to request additional documents and/or drawings as required to clarify and amplify the intent or meaning of documents and/or drawings furnished.

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.

At least 30 days prior to each design review meeting, the Contractor shall submit the required copies of the agenda and a data package and required submittals covering information to be addressed in the meeting. Design review meeting minutes shall be prepared by the Contractor and submitted to WMATA for review and approval within five business days after each meeting.

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

18.3.1 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.

No extension of time and schedule will be allowed for revision and resubmittal of Contractor's submittals, which have been "disapproved" or "conditionally approved." Such submittals shall be resubmitted and shall be reviewed and returned to the Contractor within the same time intervals as would be allotted to the drawings and documents when initially submitted. Drawings shall be submitted in an orderly and logical sequence to enable WMATA to readily determine and review the interface relationships among elements and their subassemblies.

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.

18.3.2 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 for WMATA approval.
- Disapproved. The Contractor shall revise and resubmit the document, drawing, and data for WMATA approval prior to commencing the affected portion of the work.

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.

With the exception of the submittals identified as "approved as submitted," all other submittals shall require resubmission and approval by WMATA within the same timeframes as identified within this Section.

18.3.3 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 NEPP requirements and are not explicitly excluded from the NEPP design, Contractor shall review the design inputs and within a seven-day time period, identify how these design inputs will be accommodated within the NEPP, with any schedule and other impacts identified.

18.3.4 Conceptual Design Review

The Conceptual Design Review (CDR) meeting shall be scheduled once the Contractor notifies WMATA of their readiness for this milestone. The scope of the Conceptual Design Review involves discussion of conceptual information or the "Contractor's Vision" of how it shall successfully address the requirements of the Contract for equipment design, configuration, layout, and functionality, system operations and maintenance requirements. The purpose of CDR is for:

- WMATA and Contractor to review and confirm the procedural requirements of the Contract;
- The Contractor to present its vision of the intended design that will successfully satisfy the technical, operational and functional requirements;
- The Contractor to provide conceptual information on proposed equipment design, configuration, and layout;
- WMATA and Contractor to review intended operations and maintenance requirements;
- WMATA and Contractor to identify interface requirements between WMATA and Contractor, especially regarding communications and installation interfaces;
- The Contractor to identify information and decisions required by WMATA;
- WMATA and Contractor to review the design information provided as a part of the CDR and to agree on any modifications required to meet the contractual or functional requirements.

The Contractor shall prepare conceptual design drawings, documentation, and data for review and approval by WMATA. Upon receipt and review of the Conceptual Design Review submittals, as identified in Section 18.3.1, the CDR meetings shall be held at a WMATA designated location. Approval of all CDR submittals by WMATA is a prerequisite to proceeding to the Preliminary Design Review.

WMATA shall notify the Contractor within five (5) business days after receipt of all updated CDR information as agreed at the CDR meeting, whether its conceptual design is acceptable.

18.3.5 Preliminary Design Review

Upon received signed approval from WMATA, with the design concepts presented at the CDR, the Contractor shall prepare preliminary design drawings, documentation, and data for review and approval by WMATA. WMATA shall notify the Contractor within 30 days after the CDR which submittals from the CDR items, which are required to be submitted in greater detail for the Preliminary Design Review (PDR). Upon receipt and review of these and all of the Preliminary Design Review submittals, as identified in Section 18.3.1, the PDR Meeting shall be held at the offices of the Contractor located in the United States. Receipt of all PDR documentation is required not less than 56 days prior to commencement of any PDR meetings.

WMATA shall notify the Contractor within ten business days after receipt of all updated PDR information as agreed at the PDR meeting, whether its preliminary design is acceptable. At that time, WMATA shall also provide the Contractor with a list of those PDR submittals that shall be required to be re-submitted with greater detail for the FDR meeting. Approval of all PDR submittals by WMATA is a prerequisite to proceeding to the Final Design Review.

18.3.6 Final Design Review

The Final Design Review (FDR) shall take place when the design is essentially complete and the Contractor has received signed approval from WMATA for the PDR submittals. The purpose of the FDR is to provide WMATA and the Contractor a final opportunity to review, revise, agree, and finalize the details of the NEPP design prior to release of all designs for manufacture and systems development. FDR submittals shall include all finalized submittals of all required drawings, documents, and data.

Upon receipt and review of the Contractor's Final Design Review package, as identified in Section 18.3.1, the FDR meetings shall be held at a WMATA designated facility. Receipt of all FDR documentation is required not less than 77 days prior to commencement of any FDR meetings.

The FDR shall be deemed completed when the final issues regarding the design of the fare collection system hardware and software have been resolved, all open design issues have been resolved, the NEPP is found to be in accordance with the requirements of the Contract and WMATA approves the FDR submittals.

18.4 Project Drawings

WMATA will provide to the Contractor the final design drawings of WMATA stations and facilities for which NEPP equipment and infrastructure will be required. Contractor shall provide final design drawings for these WMATA stations and facilities, based on modifications required to accommodate:

1. The Contractor's proposed NEPP components;
2. WMATA's specified requirements;
3. Agreements reached between WMATA and the Contractor; and
4. Safety and pertinent regulations and standards.

These final design drawings shall be used as record drawings and shall be modified to become the as-built drawings to be delivered to WMATA at the completion of each Phase.

1. The Contractor shall maintain "as-built" or record drawings of all work and subcontractors work continuously as the project progresses.
2. The drawings shall be kept up-to-date and shall be certified by the Project Manager.
3. Deviations from the drawings, mechanical and electrical lines, details, and other work shall be finally incorporated.
4. Where the Contract Drawings are not of sufficient size, scale, or detail, the Contractor shall furnish drawings to develop the details and dimensions.
5. This final and record set of "as-built" drawings shall be stamped "As-Built," signed and dated by the Contractor, and shall be delivered to the Project Manager prior to WMATA's acceptance of the Work.
6. The Drawings shall be provided to WMATA in the latest version of AutoCad.

18.5 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 18-1	Submit the NEPP Management Plan.	18.1.2	Within 30 days after NTP	Yes
CDRL 18-2	Submit the NEPP Risk Management Plan.	18.1.4	Within 30 days after NTP	Yes
CDRL 18-3	Submit the Master Program Schedule in accordance with the requirements of the Contract.	18.1.5	Within 30 days after NTP	Yes
CDRL 18-4	Submit a monthly progress report by the fifth day of each month that covers activities for the previous month.	18.1.6	5th day of every month	Yes
CDRL 18-5	Prepare and distribute an agenda to all participants expected to attend the meetings seven days prior to the scheduled meeting date	18.1.10	7 days prior to scheduled Progress Review Meeting	Yes
CDRL 18-6	Submit a Quality Assurance Program Plan. This Plan shall also include Reliability Assessment Program elements.	18.2.2	Within 60 days after NTP	Yes
CDRL 18-7	Provide all procedures and processes for the creation of the software modules from the source code to the executables, and for the checking and verification of the versions of each of the software modules against the version of software deployed in the field on NEPP devices.	18.2.6	FDR	Yes
CDRL 18-8	Provide documents, drawings, and data including all information conveyed for the design review meetings, as described within this Technical Specification section and their completed, final form and all other submittals described in this Contract.	18.3	CDR, PDR, FDR	Yes
CDRL 18-9	Submit the project action item log on which all action items identified during the design reviews shall be recorded.	18.3	Within 30 days after NTP	

End of Section 18

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19 DEPLOYMENT, INSTALLATION AND TESTING

This section covers the deployment plan, as well as the installation and testing requirements of the New Electronic Payments Program (NEPP). The NEPP shall be deployed in a phased manner – by mode of transportation, by device, and by available functionality within the overall NEPP as determined by WMATA.

19.1 Deployment Plan

WMATA requires that NEPP functionality be deployed in phases. Each of these phases shall be implemented system-wide over the existing WMATA service area and all equipment and components of each phase shall be fully installed and tested before deployment starts on the subsequent phase.

WMATA requires the NEPP to be fully deployed over a period of forty-eight (48) months following Notice to Proceed (NTP). The Contractor shall be required to develop a NEPP Systematic Phased Deployment Plan that suits the functional requirements of WMATA. The Deployment Plan shall be developed such that no WMATA mode of service shall be inhibited in its operation during any of the proposed deployment phases. The Contractor proposed NEPP Phased Deployment Plan shall be submitted to WMATA within 30 days of NTP. **CDRL 19-1**

19.2 Phase Duration and System Testing

WMATA requires that the NEPP be deployed as quickly as possible while ensuring a successful overall program as well as minimal impact on the WMATA's Customer satisfaction levels. The duration of each implementation phase will be based on the speed at which the required services and systems can be developed, tested, successfully implemented, and found to be in accordance with the specified requirements by WMATA.

When a subsequent deployment phase requires the implementation of a new function or set of functions into the accepted NEPP or any accepted NEPP element from a previous deployment phase, a comprehensive test of the feature and a regression test of its impact on the entire NEPP shall be conducted in the NEPP Simulator Lab (NEPP SL) (see Section 20). The NEPP SL shall mimic and represent the entire deployed NEPP. Subsequent to successful testing of the feature at the NEPP SL, the feature shall be subjected to a limited test at selected NEPP equipment locations in revenue service (to be determined by WMATA) before implementation of the functionality occurs system-wide. The NEPP SL shall not be used for training purposes by the NEPP Contractor.

The NEPP deployment phases shall be additive – that is, implementation of a phase requires that implementation of the previous phase be complete and accepted by WMATA. Unless specifically identified as removed, all functions deployed in a prior phase are to remain functional in subsequent phases.

19.3 General Installation Requirements

All equipment removal and installation work shall be performed in accordance with the WMATA standard requirements included as an Appendix to the Technical Specification. Where the requirements below are in conflict with or are less restrictive than the WMATA standard requirements, the WMATA standard requirements shall take precedence.

19.3.1 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 and installation location and all NEPP equipment provided under the NEPP Contract, as well as installation testing periods and any support requested of WMATA to properly install the equipment.

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. As a part of this plan, installation templates shall be provided for each of the items of NEPP equipment provided as a part of the NEPP contract. These templates shall be submitted at the Preliminary Design Review and approved at the Final Design Review.

The IIP shall include installation instructions and drawings for each type of vehicle on which NEPP equipment is installed. The Contractor shall be responsible for all installation aboard vehicles and WMATA will support these installations including moving the vehicles to the installation locations within each of the vehicle facilities and other similar tasks.

The IIP shall include a description of the procedures to be followed for the implementation of a new system feature, a new equipment feature, and a new type of equipment. These procedures shall be general step-by-step procedures, which can be applied to the implementation of any new item of equipment or new feature and shall incorporate the use of the Simulator Lab as described in the Technical Specifications.

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 19-2**

Approval of the IIP by WMATA shall be required prior to the delivery of any NEPP component to the installation site.

19.3.2 Site Access and On-Site Work

On-site work for the installation and acceptance testing of NEPP equipment will be located in and around WMATA facilities. 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's standard general installation requirements.

The Contractor shall install and test equipment on WMATA vehicles; this work shall be conducted at WMATA facilities.

The Contractor shall take into consideration the following guidelines for on-site work:

A. Avoid disruption of WMATA service and operations;

B. Avoid restricting public rights-of-way.

The Contractor shall protect all utilities, WMATA equipment and property, streets, and private property, and shall repair any damage to same at Contractor's expense.

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

19.3.3 Site Specific Work Plan

The NEPP Contractor shall develop a Site Specific Work Plan (SSWP) for each station, bus facility, parking garage, and all other locations where work shall be performed as part of this contract. **CDRL 19-3** The SSWP shall provide WMATA with a detailed description and breakdown of all construction and installation requirements necessary for any given location, including detailed narrative.

The SSWP shall also 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 Contractor shall also detail 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. This information shall be provided in the SSWP.

The SSWP shall also provide a description of work and a breakdown of labor force that outlines labor, equipment, and responsibilities of each party, including WMATA Force Account 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, as necessary, also include:

- Requirements for a Contractor's watchperson;
- Required WMATA flagging and support;
- 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, in order to install NEPP equipment, the Contractor may need to foul a section of track or require a complete service outage. As noted in Section 19.3.3, the SSWP 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 all SSWPs for WMATA review at the Preliminary Design Review. Final SSWPs shall be submitted for WMATA's review and approval at the Final Design Review.

An SSWP for a given location shall be submitted no less than 60 days prior to the commencement of work. No work shall begin at a location until the related SSWP has been submitted by the Contractor and approved by WMATA.

19.3.4 Site Specific Safety Plan

The NEPP Contractor shall develop a Site Specific Safety Plan (SSSP) for each station, bus facility, parking garage, and all other locations where work shall be performed as part of this contract. The SSSP shall provide WMATA with a detailed description and breakdown of practices and procedures that shall be undertaken and enforced by the Contractor in compliance with:

OSHA Regulations and Standards applicable to the scope of work defined within this Section and these Technical Specifications; and

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 SSSP shall include every precaution necessary to assure the safe access and egress of all WMATA patrons and employees, the safe and continuous operation of all WMATA vehicles, ensure the appropriate protection of the environment as well as the safety and general welfare of the public at large.

The Contractor's SSSP shall include an Employee Safety Program, 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. Cranes;

J. Electrical Protection;

K. Drug and Alcohol;

L. Public and Passenger Protection.

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 SSSP shall provide a detailed description and breakdown of practices and procedures for the following Regulatory and Safety requirements:

M. General Safety Requirements;

N. Emergency Procedures;

O. Protection of WMATA Facilities;

P. Storage and Handling of Materials;

Q. Environmental Protection, including but limited to:

R. Protection of Natural Resources;

S. Erosion and Sediment Controls;

T. Toxic Substances;

U. Control and Disposal of Chemical and Sanitary Wastes;

V. Dust Control;

W. Protection of Existing Water and Sewer Lines;

The Contractor's SSSP shall also provide a detailed description and breakdown of practices and procedures for the following additional Site Specific Safety 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 SSSPs for WMATA review at the Preliminary Design Review. Final SSSPs shall be submitted for WMATA's review and approval at the Final Design Review. **CDRL 19-4**

An SSSP for a given location shall be submitted no less than 60 days prior to the commencement of work. No work shall begin at a location until the related SSSP has been submitted by the Contractor and approved by WMATA.

19.3.5 Existing Equipment Removal

The Contractor shall supply all of the labor, supervision and materials required for the proper and complete removal of the existing fare collection equipment that the equipment to be furnished under this contract will replace. Such removal shall be accomplished without damage to the removed equipment, the vehicle, 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, which shall include at a minimum flush filling of any holes and removal of any exposed conduit stub-ups and wiring.

In addition, 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 how this will be done in the SSWP.

19.3.6 Removed Equipment Storage

The Contractor shall place the removed WMATA fare collection equipment at a Contractor-provided local storage location 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.

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

19.3.7 New Electronic Payments Program Equipment Installation

The Contractor shall supply all labor, supervision, and materials required for installation of all new NEPP equipment. Installation of the new equipment shall include fastening and anchoring the equipment, and the installation of a NEPP communications cabinet at stations with an existing communications closet. WMATA will provide power in the vicinity of the communications cabinet. Following NTP, the Contractor shall document all power requirements for the NEPP communications equipment, and shall provide detailed justification for any power requirements in excess of one (1), 110VAC, 60 Hz, single phase, 15A, circuit. **CDRL 19-5**

Additionally, WMATA will provide power in the general proximity of all NEPP field devices that will be deployed by the Contractor. The Contractor shall again document all power requirements for the field devices following NTP. **CDRL 19-6**

19.3.8 Metrorail Station Equipment Installation

Station equipment 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, 0.5-inch diameter 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.

Power and Communications connectivity will vary among the stations within the System. WMATA shall provide power in the proximity of the NEPP equipment and field devices in accordance with the Section 19.3.7.

No equipment shall be installed within passenger shelters or waiting rooms.

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. **CDRL 19-7**

19.3.9 Bus Facility Equipment Installation

At each Bus Facility, the Contractor shall utilize the MetroNet facility LAN to support the installation of NEPP equipment. As part of the facility LAN, should additional network hardware be required, including modems and/or hubs, the Contractor shall provide and install a secure NEPP communications cabinet. The communications cabinet shall house all additional network hardware, except wireless access points..

Documents and drawings detailing design and installation of equipment at Bus Facilities shall be submitted for WMATA review at the Conceptual Design Review and for approval at the Preliminary Design Review. **CDRL 19-8**

All special tools required for the installation or removal of the NEPP equipment shall be provided to WMATA as a part of the first equipment delivery.

19.3.10 Mobile Equipment Installation

The Contractor is required to provide all labor, supervision as well as materials necessary for the proper installation of the On-Board Bus Processor Target (OBPT) equipment in WMATA vehicles.

The OBPT equipment shall be positioned for maximum ease of passenger movement and vehicle operator operation. The installed position will allow for complete, unrestricted opening of all access door(s) and shall ensure that all ADA ingress and egress requirements are satisfied for all ADA compliant access door(s). The Contractor shall be responsible for modification to and repositioning of handrails and movement and reinstallation of other equipment, which may interfere with these access doors. The position of the equipment when mounted in the vehicle shall allow for clear view by the operator from a normal, upright driving position of the coin and bill insertion areas and the OCD. When installed, all OBPT equipment shall meet all applicable ADA requirements.

The Contractor shall supply and install all the necessary wiring, protective devices, and mounting hardware necessary for the proper installation and operation of the equipment. All new undercarriage wiring will be suitably protected against the road elements and fastened in a manner to not interfere with normal vehicle operation and/or maintenance. No "butt connectors" shall be utilized on or under the vehicle.

All mobile equipment installation plans and material lists shall be submitted to WMATA for approval during Final Design Review. **CDRL 19-9**

19.3.11 CDS Installation

The CDS shall be installed in a location to be identified by WMATA within 120 days of NTP. Power source of 110 VAC, 60 Hz will be available within 10 feet of the server. The Contractor shall document all power requirements for all components of the CDS within 45 days of NTP. **CDRL 19-10**

WMATA will supply all environmental controls for the CDS installation.

The Contractor shall furnish and mount equipment (e.g. racks) onto which hardware shall be installed.

The Contractor shall furnish all interfaces required for communication with all other NEPP equipment and test the operation of the CDS once installed.

19.3.12 Simulator Lab Installation

The Contractor shall install the Simulator Lab (see Section 20) in a location to be identified by WMATA within 120 days of NTP. WMATA will provide power at a central location within the designated area. The Contractor shall document all power and environmental requirements for the Simulator Lab devices within 45 days of NTP **CDRL 19-11**.

WMATA will provide environmental control at the designated location.

The Contractor shall furnish and mount all equipment onto which hardware shall be installed.

19.3.13 Systems Integration

The Contractor shall work with WMATA's Project Manager to coordinate with any system integrators of other interfacing systems, to facilitate the specified system implementation.

19.4 NEPP Test Program

The objective of the NEPP Test Program is to ensure that all hardware, software, interfaces, supporting equipment, smart media, and other system elements furnished under this Contract meet all specified requirements within this document. The Contractor shall conduct all testing and maintain responsibility for satisfactory completion of the testing and system implementation.

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. These possible actions shall not be included in any schedule assumptions made by the Contractor. The Contractor shall prepare all testing materials prior to conducting any tests, and prepare test reports providing the results of the testing.

19.4.1 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 NEPP, including all elements, subsystems, and the system as a whole, perform as specified. 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 in this Section 19.

Testing and verification of the operation and functionality of the NEPP shall commence using First Articles of all NEPP devices 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.

19.4.2 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 system 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 19-12**

19.4.3 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;

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;

O. Test results.

The test procedures shall be provided to WMATA 45 days prior to the scheduled date for each 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 prior to test commencement. **CDRL 19-13**

19.4.3.1 Test Failure Resolution

The procedures to be followed for the resolution of test problems, failures, inaccuracies, and general test conduct ground rules of failure resolution shall be defined, and included in each of the test procedures. This information will be approved by WMATA prior to commencement of the associated test identified within this Section. **CDRL 19-14**

19.4.3.2 Test Waiver Requests

At WMATA's sole discretion, portions of the tests may be waived upon written request from the Contractor 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 (UL or European equivalent);

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. **CDRL 19-15**

19.4.4 Test Results Reports

Test reports, as identified in Section 19.4.3, 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.

Inspection reports, test certifications, and test reports shall be signed and certified by the Contractor's authorized Quality Assurance/Quality Control representative. The QA/QC representative shall submit daily inspection reports identifying participating personnel; equipment, material tests, results, and defects. Such reports shall be signed and certified by the Contractor's authorized QA/QC representative.

19.5 Component and System Level Testing

The Contractor shall subject all components of the NEPP 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 NEPP, including all elements, subsystems, and the system as a whole, as well as the level of functionality required for each phase of deployment. The Contractor shall furnish NEPP equipment that meets the criteria specified for all tests. Testing shall not commence until all designs affecting the respective equipment 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.

19.6 Testing Phases

As the NEPP shall be implemented in several phases to suit the functional requirements of WMATA, the functionality and equipment for the NEPP 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;
- Verify that the CDS and all of its applications performs as required by WMATA in these Technical Specifications; and
- Ensure that there is no performance degradation when additional functions are implemented (rigorous regression testing shall be provided).

For all tests which must be repeated at the onset of each phase subsequent to the initial tests, in addition to the new functionality provided, 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.

19.7 Network Operation Testing

The CDS, network, and communication system, shall be fully installed and tested prior to the implementation of any NEPP field equipment. This testing shall be performed for all portions of the communications network, wired as well as wireless.

Once the CDS, network and communication systems have each been installed as required for the initial implementation phase, in preparation for the NEPP field equipment delivery, its connectivity shall be tested and verified by the Contractor.

In addition, this test shall also verify that the CDS, network and communication systems can fully support and operate as specified for each phase of the program at a capacity level representing 99% of the anticipated transaction load for that phase, based on the quantity and type of NEPP equipment installed for that phase. The capacity verified shall be as identified in Section 2.

The Contractor's plan for this test shall be provided for WMATA approval at the Final Design Review. This test plan shall identify all aspects of the testing to be performed as well as the test equipment and procedures to be used. **CDRL 19-16**

This test shall be performed to demonstrate that the all network systems (wired or wireless) and all related sub-systems have been properly configured and optimized; and that they will operate fully and properly without a major system failure. This test shall be performed after all the inspections, checks and tests defined earlier in this Section have been accepted.

As part of this, network connectivity and data communication shall be verified from each point within the NEPP where field equipment shall be installed and connected. This shall include the verification that all connection points have sufficient bandwidth to support the needs of the NEPP. Continuity shall be verified from each equipment connection point through to the CDS, through its external interfaces and back to the CDS.

The results of this test shall be reported to WMATA in a report, which includes graphical illustration of results. This shall include maps of the WMATA service region, outlining connections, availability of communications, reliability, and available bandwidth. The map shall be divided as necessary to ensure that it presents geographical areas in sufficient size to allow for adequate dissemination of the data presented.

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.

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

19.8 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. For the FAT, one of each type of equipment and fully functional CDS software and hardware shall be tested to ensure that all the features, functions and requirements are provided. The FAT shall be performed at the Contractor's facility in North America. 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.

This series of tests shall include:

A.	Functional Test	**CDRL 19-17**
B.	Environmental Tests	
	1. Vibration Test	**CDRL 19-18**
	2. Shock Test	**CDRL 19-19**
	3. Electromagnetic Effects Test	**CDRL 19-20**
	4. Radiation and Electromagnetic Interference Test	**CDRL 19-21**
	5. Temperature/Humidity/Voltage	**CDRL 19-22**
	6. Water Intrusion	**CDRL 19-23**
	7. Dust Test	**CDRL 19-24**
C.	First Article Enclosure Integrity Test	**CDRL 19-25**
D.	Maintainability Test	**CDRL 19-26**
E.	CDS Software Verification Test	**CDRL 19-27**
F.	System Interface Test	**CDRL 19-28**
G.	Application Verification Test	**CDRL 19-29**
H.	Cycling Test	**CDRL 19-30**

I. Report Generation Test **CDRL 19-31**

The Contractor's plans for these tests shall be provided for WMATA approval at the Final Design Review. These test plans shall identify all aspects of the testing to be performed as well as the test equipment and procedures to be used.

19.8.1 Functional Tests

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. An item of each type of equipment 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.

19.8.2 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.

19.8.2.1 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.

Fixed Location Equipment

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.

Requirements for vibration testing shall conform to EEIG 97s0665-, ERTMS/ETCS Environmental Requirements, with Operational Requirements as per Section 2.8.2.2.2, Track (line side) and Track Side Equipment – Vibration, in accordance with the power spectral density (PSD) defined in Figure 6; and Test Requirements as per Section 2.8.4.5, Vibration: 0.23g rms, frequency range 0 to 200Hz.

Mobile Equipment

The Contractor shall ensure that all mobile equipment including any docking stations and similar hardware components proposed are both resilient and protected from vibration conditions expected in their intended environments. The testing for these various types of equipment items shall follow requirements as defined in the specific standard tests, including verification that the equipment shall demonstrate full functionality upon completion of each of the testing cycles below without modification or adjustment. 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:

A. Continuous vibration at a frequency range between 0 and 6 Hz and at an acceleration level up to 0.01g.

B. Intermittent shocks of up to 0.1g, not exceeding 20-millisecond duration, half sine wave, and repeated at intervals of 0.5 to 2.0 seconds. These intermittent shocks shall be repeated not less than twenty-five (25) times.

C. Vibration: sweeps over a frequency range of 5 Hz to 150 Hz to 5 Hz at 1.5g acceleration. Each sweep shall occur over a 12-minute interval and shall be repeated five (5) times. This shall be performed on all three axes and the cycling time shall be for one hour on each of the three axes, 0.3g (rms), 5 to 200 Hz.

19.8.2.2 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:

Fixed Location Equipment

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.

Mobile Equipment

The Contractor shall ensure that all equipment proposed shall be tested per MIL-STD-810G, Method 516.6, Section 4.6.5, Procedure IV. The equipment shall operate normally after the shock tests and shall not have experienced broken or loosened component as a consequence of these tests.

19.8.2.3 Electromagnetic Effects Test

The Contractor shall ensure that all equipment proposed shall be tested for electromagnetic interference as 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 NEPP 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.

Or

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;

Or

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.

19.8.2.4 Temperature/Humidity/Voltage Test

The temperature and humidity requirements for these tests are as identified in Table 19-1 below. Each of these tests are to be performed on each type of NEPP equipment, excluding those types which operate exclusively in an indoor environment. This shall include FVDs, Metrorail faregates, ADA faregates, PVs, HSDs, OBPTs, parking system equipment, and data communications system equipment.

Once the specified temperature and humidity levels have been reached in the test chamber for a particular test, the NEPP 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.

All equipment 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 19-1 and the equipment cycled as per procedures established for Cycling Tests (Section 19.8.8).

Table 19-1 – 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		Maximum per Section 2	250
5	32° F	80		nominal -5%	250

Successful completion of this phase of the Environmental Test requires no more than one relevant failure as defined in Section 19.14.5.

19.8.2.5 Water Intrusion Test

All NEPP equipment installed in station and bus environments 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.

19.8.2.6 Dust Test

All NEPP equipment, including indoor equipment such as the CST and CDS servers, 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 in Table 19-2.

Table 19-2 – Dust Exposure Test

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

19.8.3 First Article Enclosure Integrity Test

Upon successful completion of the First Article Configuration Inspection (FACI), the First Article NEPP devices 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 enclosure shall be leveled and fully secured.

B. Each device 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 NEPP device 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.

19.8.4 Maintainability Test

The Contractor shall conduct a Maintainability Test of the equipment. 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 Mean Time to Repair (MTTR) for all NEPP equipment shall be as identified in Section 2.

The test shall be conducted in the following steps:

A. The Contractor shall provide multiple units of the equipment to introduce failed components, mis-adjustments and incorrect settings. The simulated failures shall be introduced in proportion to their expected failure rate. No fewer than three units shall be provided for each type of equipment.

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.

19.8.5 CDS Software Verification Test

The Contractor shall conduct a CDS 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 field equipment is required so the functionality can be proven. This equipment, however, need not be connected in any way to the CDS except via simple network connection. The functions covered shall include all functions provided by any NEPP server and shall include, for example:

- All functions controlled by the Application server;

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

- System setup, including security accesses, including network address allocation;
- System monitoring;
- Alarm generation and reporting;
- Fare structure creation and revision;
- Query and report generation and execution;
- Automatic generation of daily summary tables;
- Data archiving and recovery;
- Network server management and network problem identification;
- Conductor remittances and reconciliation;
- Smart media tracking and inventory system.

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 NEPP field equipment.

19.8.6 System Interface Test

The Contractor shall design and conduct the System Interface test to evaluate how well and accurately the equipment and software provided within this contract interface together. 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 each equipment unit and the system, providing a high degree of confidence for the reliability. The interfaces to be tested shall include all interfaces between the NEPP devices, including depot based equipment, fixed location equipment, mobile equipment, and all servers.

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 those, which are external to the CDS. These shall include, but not be limited to:

- Wireless Communication System;

- Business Recovery Center;
- Clearinghouse;
- Web-based Customer Service Application.

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. This testing shall include the communications with and between all sub-systems as well.

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 NEPP field equipment.

19.8.7 Application Verification Test

Each CDS application shall be tested to verify that is operating properly. All applications as identified in the various paragraphs in Section 16 shall be verified to ensure proper and expected operation. This shall include all NEPP applications.

Every menu selection shall be tested to ensure that the expectations of WMATA are met and to ensure that the progression of the functionality for the applications are correct. This shall also include testing security and access to the various elements, forms and other items to be completed to execute the application, form functionality, reports resulting from the functional operation, interfaces to other WMATA systems and CDS applications, parameter identification and modification to ensure that the parameter changes produce desired results, verification of ad-hoc queries and other necessary functional elements. Also of critical importance is that each of these functions shall be timed in order to verify that the performance is also acceptable.

In addition, for those applications which are mirrored in the existing WMATA system, parallel testing against these existing legacy systems shall also be included in the testing to ensure data concurrence between both systems.

Separate test reports with the results of the application test shall be provided to WMATA for approval and all deficiencies shall be corrected before the FAT can be considered completed and accepted.

19.8.8 Cycling Test

The cycling test shall be conducted for all NEPP equipment. The cycling tests shall be conducted at a minimum, as shown in Table 19-3. 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;
- LUM – Limited Use Media (issued by NEPP);
- Bankcard - Contactless credit/debit smart media and Open Payment smart media.

In addition, the cycle test shall also include not less than 10% additional transactions with invalid media. The invalid media shall be verified against each type of equipment, which reads and verifies smart media as valid for a particular mode of transportation service. Issue of smart media shall include the storage of the validity information in the CDS account.

Table 19-3 – Minimum Cycle Test Requirements

Trial #	Media Type	Transaction Description	Qty.	Tests
FVD, Sales Device (SD)				
1	SM	Issue with Monthly Pass stored	25	3
2	SM	Issue with Stored Value	25	3
3	LUM	Issue with Stored Value	25	3
4	LUM	Issue with One Way Media	25	3
5	LUM	Issue with Round Trip Media	25	3
6	SM	Add Stored Value	30	3
7	SM	Add Monthly Pass	40	3
8	LUM	Add Stored Value	40	3
9	LUM	Add One Way Media	40	3
10	LUM	Add Round Trip Media	40	3
11	SM	Read information on Smart Media	80	1
12	LUM	Read information on Limited Use Smart Media	80	1
For trial 1-12, each is to be purchased using cash, credit media and debit media				
Handheld Validation and Sales Device (HVSD)				
13	SM	Read all media from trial 1	25	1
14	SM	Read all media from trial 2	25	1
15	LUM	Read all media from trial 3	25	1
16	LUM	Read all media from trial 4	25	1
17	LUM	Read all media from trial 5	25	1
18	Bankcard	Use at entry and exit faregates and checked upon exit	25	1
19	Bankcard	Onboard purchase of single trip	25	1
20	Bankcard	Onboard purchase of multiple adult fares	25	1
21	SM	Read all media from trial 6	30	1
22	SM	Read all media from trial 7	40	1
23	LUM	Read all media from trial 8	40	1
24	LUM	Read all media from trial 9	40	1
25	LUM	Read all media from trial 10	40	1
26	SM	Read all media from trial 11	55	1
27	LUM	Read all media from trial 12	55	1
28	LUM	Issue Media with exact fare	25	1
29	LUM	Issue Media with change	25	1
30	LUM	Issue Media with credit card	30	1

Trial #	Media Type	Transaction Description	Qty.	Tests
Platform Validator (PV)				
31	SM	Read all media from trial 1	25	1
32	SM	Read all media from trial 2	25	1
33	LUM	Read all media from trial 3	25	1
34	LUM	Read all media from trial 4	25	1
35	LUM	Read all media from trial 5	25	1
36	SM	Read all media from trial 6	25	1
37	SM	Read all media from trial 7	25	1
38	LUM	Read all media from trial 8	25	1
39	LUM	Read all media from trial 9	40	1
40	LUM	Read all media from trial 10	40	1
41	SM	Read all media from trial 11	55	1
42	LUM	Read all media from trial 12	55	1
On-Board Bus Payment Target (OBPT)				
43	LUM	Validate One Way Media	50	1
44	LUM	Validate Round Trip Media	50	1
45	LUM	Validate Stored Value on Media	50	1
46	SM	Validate Monthly Pass	50	1
47	SM	Validate Stored Value on Media	50	1
48	SM	Read all media from trial 1	25	1
49	SM	Read all media from trial 2	25	1
50	LUM	Read all media from trial 3	25	1
51	LUM	Read all media from trial 4	25	1
52	LUM	Read all media from trial 5	25	1
53	SM	Read all media from trial 6	25	1
54	SM	Read all media from trial 7	25	1
55	LUM	Read all media from trial 8	25	1
56	LUM	Read all media from trial 9	40	1
57	LUM	Read all media from trial 10	40	1
58	SM	Read all media from trial 11	55	1
59	LUM	Read all media from trial 12	55	1
60	SM	Pass + Pass upgrade (coin)	40	1
61	SM	Pass + Pass upgrade (bill with change)	40	1
62	SM	Pass + Pass upgrade (coin + bill)	40	1
63	SM	SVC + coin	20	1
64	SM	SVC + bill with change	20	1
65	SM	SVC + bill + coin	20	1

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

19.8.9 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.

All functions requiring interface to the CDS, including all alarm, event, and boundary conditions and security provisions, in all possible combinations, shall be tested. 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 the CDS (for all devices);

C. Data transmission from the CDS (for all devices);

D. Fare Table modification, download and verification simultaneously to all devices;

E. Configuration modifications from all devices;

F. Automatic report generation at the CDS.

The Contractor shall identify each integrated function in its Test Procedures, including the boundary conditions and security provisions for each item of equipment and operation. Where possible, at a minimum each report shall be verified against two other reports.

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 by the CDS. 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. These samples reports available shall be generated by the CDS Contents of the reports shall be provided as part of the Final Design Review CDRL identified. Successful completion of the test requires no discrepancies between report contents and known data as well as proper formats.

19.9 Production Acceptance Test (PAT)

This test will be performed by the Contractor at its North American facility to verify each item of equipment, is 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 Pilot Test and RMAT testing. Successful completion of the PAT is a prerequisite for delivery of equipment to WMATA's sites for PIC verification, installation, and IAT testing.

The Contractor's plan for the PAT shall be provided for WMATA approval at the Final Design Review. These test plans shall identify all aspects of the testing to be performed as well as the test equipment and procedures to be used. **CDRL 19-32**

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.

19.10 Pre-Installation Checkout (PIC)

Prior to commencement of the Pilot Test, a Pre-Installation Checkout (PIC) shall be conducted at the Bus Facilities. WMATA will select five sets of mobile equipment at random from delivered items plus the CDS including hardware and software to run all reports and provide data transfer for the PIC. 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 verify that the mobile equipments work as expected by exercising them to check log-on/log-off and to verify their operating functions by processing various fares;

D. To ensure that all data reports are produced in accordance with specifications; and

E. To determine by these procedures if installation can begin or corrections and/or adjustments are needed followed by a retest before installation can begin.

This equipment shall be set up at the Bus Facility by the Contractor in such a manner as to permit all of the above listed test objectives to be evaluated. The following sequence of tests shall be conducted as a minimum:

A. The mobile equipment shall be powered using a power supply(ies) furnished by the Contractor.

B. The mobile equipment shall be programmed for vehicle number and correct fares downloaded from the CDS.

C. Visual inspection of the mobile equipment shall be made to ensure that there is no physical damage and that all specified displays, messages, and prompting sequences including tone coordination occur as specified.

D. Log-on procedures shall be completed followed by processing at least three fares of each type provided in the fare structure for the system.

E. Log-off procedure and data collection shall be completed and CDS printouts reviewed.

Successful completion of PIC shall be a prerequisite for Pilot Test installation to begin.

19.11 Installation Acceptance Test (IAT)

This test will be performed by the Contractor at the sites selected by WMATA to verify that the equipment, which successfully completed PAT testing, continues to perform as expected after it has been installed, and prior to revenue service. This test will occur for all equipment that will be part of both the Pilot Test and RMAT testing. IAT shall however not begin unless training to WMATA employees had been provided and manuals that correctly represent and depict all functionality are provided.

Successful completion of the IAT is a prerequisite to conduct the Pilot Test. The Contractor's plan for the PAT shall be provided for WMATA approval at the Final Design Review. These test plans shall identify all aspects of the testing to be performed as well as the test equipment and procedures to be used. **CDRL 19-33**

19.12 Pilot Test

This test shall be performed after successful completion of the IAT on a predetermined set of equipment. This shall be performed at the commencement of each phase of the project. The test shall be conducted with a population of devices equal to no less than 10% of the quantity of the device being provided within this contract. If the number of devices or systems to be provided is equal to one, that device is not subject to the percentage factor. However, the single device and/or system shall be required to participate in the Pilot Test.

The Pilot Test 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 exact number of devices (by type) participating in the Pilot Test shall be decided upon no later than 60 days prior to the scheduled start of the FAT. This is shall encompass the initial complement of NEPP equipment installed as agreed no later than 60 days prior to the scheduled start of the FAT.

The first seven days of the Pilot Test 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 (see Section 19.14.4.) The FRB shall review the reported failures, categorizing them for inclusion into the Pilot Test 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 Pilot Test shall begin and shall be conducted over the next 28 days. The Contractor shall be responsible for performing all maintenance actions during Pilot Test.

19.12.1 Pilot Test Requirements

The NEPP equipment participating in the Pilot Test shall be operated in full revenue service during the Pilot Test. Requirements specified for both the Accuracy Test and the Reliability Test are identified in Table 19-4 and shall be met to pass the Pilot Test. When the Pilot Test is passed, the equipment shall remain in revenue service. The Pilot Test results and data collected shall be reviewed weekly by WMATA.

Table 19-4 – Pilot Test Requirements

Week #	Reliability (% of required MCBF)	Equipment Accuracy (data reporting)	Equipment Accuracy (payments)	Cash Container Audits
1 (settling period)	90.0%	99.0%	99.8%	2 failures at 95.0%
2	92.0%	99.5%	99.8%	2 failures at 96.0%
3	96.0%	99.6%	99.9%	2 failures at 97.0%
4	100.0%	99.7%	99.9%	2 failures at 98.0%
5	100.0%	99.9%	99.9%	2 failures at 98.0%

19.12.2 Pilot Test Reliability

This test shall be conducted with all the Pilot Test equipment. Each item of equipment shall be monitored throughout the test period. All conditions for equipment errors, repairs, adjustments, replacements, malfunctions, (of mobile equipments or parts/modules thereof) shall be fully documented for the entire test period.

The minimum reliability requirements stated within Table 19-4 shall be achieved during the specified period, for the Pilot Test to continue. If the MCBF requirements specified are not met at the period indicated, WMATA will have the right to suspend the Pilot Test until the Contractor submits and implements a plan to rectify the error conditions.

For computer systems, there shall be no more than one failure of any computer system throughout the duration of the test.

19.12.3 Pilot Test Accuracy

This test shall be conducted with all the Pilot Test equipment. This Pilot Test equipment shall be monitored daily and results recorded. The minimum accuracy requirements stated above shall be achieved during the test schedule. If during any week of the test, the Accuracy requirements specified are not achieved, for the periods indicated, WMATA will have the right to suspend the Pilot Test.

In addition to the verification of the accuracy of the collected revenues, a data accuracy review shall be performed. This review shall serve to ensure that all data is reported properly and accurately. The test will also prove that the same information is consistently and accurately represented on reports. The test shall also verify that all column and row totals are properly and accurately calculated and that all alarms and messages sensed are recorded at the fare device and reported to the CDS.

All reports available from the fare devices and the CDS shall be printed on five random days, at least once for each week during the Pilot Test. The dates for printing these reports will be randomly selected by WMATA, with no prior knowledge provided. These reports will be used to perform the accuracy testing.

19.12.4 Failure of Pilot Test

In the event that the equipment or a system fails the Pilot Test, the Contractor shall have up to thirty (30) days to correct or update the equipment, so a retest can commence. If at the end of this Pilot Test re-test, the result is a failure, WMATA may elect for cancellation of the contract.

19.13 Integration Test

The purpose of this test is to verify that all NEPP components are fully integrated to perform as a single system for WMATA. The Integration Test shall ensure that all NEPP equipment can successfully process the smart media issued and/or processed by the all other equipment procured under each contract. This test shall verify that each smart media processor within the NEPP encodes data and sets up accounts properly for all types of smart media identified in Section 3 and that each type of smart media can be properly processed by the equipment. The procedures to be used during the Integration Test shall be presented to WMATA by the Contractor at PDR and finalized prior to the commencement of the RMAT. **CDRL 19-34**

Each transaction performed as part of this test shall be performed using smart media that was initialized/sold/activated/replenished from each type of fare card processing device to ensure that cross-compatibility is provided.

With successful completion of this test, all software shall be “frozen” and no changes shall be made without authorization of WMATA. The Contractor shall record version information for all software modules installed on the equipment. These records shall include the date and time the software was created, size of each file, and version number.

19.14 Reliability, Maintainability and Accuracy Test (RMAT)

The RMAT will begin after successful conclusion of all equipment installations and the successful completion of the Pilot Test, at the commencement of each phase of the project. This test shall run for a period of not less than 91 consecutive days and shall verify that the system is operating in a reliable and accurate manner for all installed equipment. This test shall be performed after all equipment, hardware and software has been installed, training has been completed (as identified in Section 21), and the manuals and documentation (as identified in Section 20) have been provided.

During the RMAT, the Contractor shall record reliability, maintainability, and accuracy data to be reviewed by WMATA at the 4th, 8th and 13th week stages to evaluate the performance for the preceding 4 or 5 week period, as applicable. The RMAT test results and data collected shall be reviewed weekly with WMATA. Reliability, maintainability, and accuracy at each phase of the project shall meet the performance requirements specified in these Specifications.

System acceptance of the NEPP by WMATA shall require passing the RMAT and the Contractor furnishing all required hardware, software, spare parts, documentation, training, supplies and all other items and deliverables identified in these Specifications. As with the Pilot Test, this test shall be performed for each phase of the project.

19.14.1 Reliability Test

All conditions of equipment errors, adjustments, replacements, malfunctions, and failures shall be fully documented by the Contractor for the entire test period for the RMAT. The Failure Review Board (FRB) shall ascertain what constitutes a failure during the RMAT. Details for the Failure Review Board are contained in Section 19.14.4.

19.14.2 Accuracy Test

During the course of the RMAT, overall accuracy of the NEPP shall be evaluated. Within this Section, cash revenues shall refer to cash – bills and coin; card revenues shall refer to credit and debit card transactions as well as deductions from all types of smart media. Weekly totals of the cash receipts collected from all cash accepting devices shall be tabulated per device by WMATA. At the end of each week, each cash accepting device shall be visually inspected to ensure that each cash/coin box/vault is empty in preparation for the next cycle of testing. These totals shall be compared against the cash revenue totals as reported by the CDS during the service period in question. The physically counted cash revenues, when compared to the CDS reported totals, shall be within ±0.05%, including the value of recovered jammed coins and bills. Failure to meet this requirement for any week shall be fully investigated and reported by the Contractor.

Weekly totals of the card revenue receipts collected from all card-accepting devices shall also be tabulated per device by WMATA. The card revenues, when compared to the CDS reported totals, shall be within ±0.001%. Failure to meet this requirement for any week shall be fully investigated and reported by the Contractor.

For the NEPP to be accepted, the individual device and overall system accuracy of the reported cash and card receipts shall be maintained within ±0.05% and ±0.001% of the physically counted cash and card revenues, respectively, for each test cycle during the entire test period. If discrepancies in the accuracy during the warranty period exceed above listed requirements, the Contractor shall take corrective action. This corrective action shall be subject to WMATA approval and at a minimum will include a failure analysis and Corrective Action Plan. After corrective action has been taken, if system accuracy records indicate that the action taken was successful for a minimum period of 30 days, the fix shall be deemed satisfactory. If not, the Contractor shall take further action until system accuracy is equal to or better than the specified requirements.

There shall be no errors with the data storage on smart cards and Limited Use media, including calculation of the fare.

There shall be no data errors or inconsistencies between the data reported within the memories of each of the items of the equipment and the data stored within the CDS, or with the reports generated by the devices and CDS.

19.14.3 Revenue Service Event Audits

Periodically during the RMAT, as a minimum of one for each two-week period, WMATA will audit reports generated by the data system to confirm the accuracy and completeness of information presented. All event records shall be reviewed and compared to known events such as door openings for revenue service or maintenance, alarms, power outages, etc. All such known events shall be correctly represented in WMATA reports.

19.14.4 Failure Review Board

Upon the commencement of revenue service, the Contractor shall compile and report all maintenance activity information. An Equipment Maintenance Report **CDRL 19-35** shall be prepared to record all maintenance related incidents so as to classify chargeable or non-chargeable operating malfunctions and operating failures. All malfunctions and failures shall be tracked by equipment type, equipment number, module type, and module serial number.

During this period, a Failure Review Board (FRB) shall be established. The FRB shall include membership as follows: Two representatives chosen by WMATA and one representative from the Contractor, for a total FRB membership of three. The FRB shall be chaired by a representative of WMATA Contracts Department, as a non-voting member.

The FRB shall determine whether reported NEPP failures are valid failures, and determine what direct corrective actions will be required. The FRB shall convene weekly during the RST to review incident reports, classify failures, and assess system accuracy. Where differences in opinion arise, the rationale for categorization will be discussed and the chargeability determined by a vote of the FRB. Results of each meeting shall be documented and approved by WMATA, and the Contractor. At the end of the RST, the FRB shall make a recommendation to accept the equipment or to extend the RST as necessary.

19.14.5 Failure Category Definition

The following conditions shall be used as a guide to classify failures.

19.14.5.1 Chargeable Failure

A chargeable failure is any malfunction, which prevents NEPP equipment from performing its designated function, or meeting its performance criteria, when used and operated under the environmental and operational conditions stated in these specifications.

Chargeable failures shall be used in computation of demonstrated reliability including intermittent failures, not otherwise excluded under non-chargeable failure types. In general, a chargeable failure can be assigned to one of the following categories:

A. Equipment design;

B. Equipment manufacture;

C. Equipment quality;

D. Parts design;

E. Parts manufacture;

F. Parts quality;

G. Software errors;

H. Equipment installation;

I. Contractor furnished operating, maintenance or repair procedures, tools, and equipment that cause equipment failure. (If procedures are correct and verified, such failures shall be chargeable as equipment failures.)

All failures induced by defective software shall be considered chargeable failures.

Unless excluded as described in Section 19.14.5.2, all failures shall be identified as chargeable, including those for which no cause can be found. Identification of a failure as non-chargeable shall be at the sole determination of the Failure Review Board based on the case set forth by the Contractor for non-chargeability, including identification of a failure as a non-chargeable failure as identified below.

19.14.5.2 Non-Chargeable Failure

A non-chargeable failure is a malfunction caused by a condition external to the equipment under test, which is neither a functional, environmental, nor a test requirement in this specification and is not expected to be encountered during normal and correct operation of the equipment in revenue service.

Non-chargeable failures shall be considered non-chargeable failures and shall include the following:

A. Accident or mishandling;

B. Failure of test facility or test instrumentation;

C. Equipment failures caused by externally applied over stress conditions in excess of the approved specifications requirements contained herein. Certain patron-induced failures such as use of torn or mutilated smart media and abuse of equipment fall in this category.

D. Normal operating adjustments not as prescribed in the approved equipment operating and maintenance manuals;

E. Dependent failure(s) occurring with the independent failure that caused them. For example, a broken part that causes multiple failures in a single device before being corrected shall be considered one independent failure with multiple dependent failures; the dependent failures shall not be chargeable.

F. Failures of expendable items having a specified life expectancy when operated beyond the defined replacement time of the item;

G. Failures caused by incorrect operating, maintenance or repair procedures.

19.14.6 Failure of RMAT

In the event that the equipment fails the RMAT, the Contractor shall have up to 28 working days to correct or update the equipment. Following the modifications, the RMAT will retest for 28 additional calendar days. Failure to pass the RMAT after this additional 28 days shall cause the Contract to be eligible for Termination for Default as defined in the Terms and Conditions.

19.15 Wireless Broadband System - Proof of Concept

The Contractor shall perform a Proof of Concept (POC) test for the Contractor's wireless broadband system. The purpose of this test is to ensure that all NEPP devices as well as the wireless broadband system are able to process all acceptable forms of smart media at the required transaction speeds when communicating over the wireless broadband system. As part of the NEPP Phased Deployment Plan, the Contractor shall propose the period during which the Wireless Broadband POC shall be conducted.

Acceptable forms of smart media and required transaction speeds are defined in Section 3. Processing of smart media within the specified transaction times shall encompass all activities defined in Section 3 of this document, and shall include, but not be limited to, authentication and authorization of all forms of smart media including contactless credit / debit media.

The Wireless Broadband POC test shall be performed utilizing NEPP devices that communicate over the wireless broadband system, and shall include, but not be limited to, OBPTs and HSDs. The geographic area over which the test is performed shall be within WMATA's service area and shall be representative of the diversity of wireless conditions that the NEPP equipment can be expected to experience in full revenue service across all modes of transportation offered by WMATA.

The Wireless Broadband POC test shall be performed for a period of not less than five consecutive weeks. The testing shall verify that the wireless broadband communication system operates correctly, reliably and accurately when subjected to actual in-service revenue conditions. The exact number, type and location of NEPP devices participating in the test shall be recommended by the Contractor no later than 60 days prior to the scheduled date of this test, and shall be subject to WMATA approval.

Testing performed shall be focused on all aspects of NEPP performance – from passenger interaction with all forms of NEPP equipment through the reporting of actual transaction data at the CDS. Accuracy and reliability requirements as defined for NEPP device testing shall also be met during this Wireless Broadband POC test.

At the completion of the POC test, Contractor shall provide a report of the results. **CDRL 19-36** These results shall include all information required by WMATA to ensure that the NEPP devices in conjunction with the wireless broadband system as provided by the Contractor demonstrates the ability to meet, or already meets, the requirements of WMATA's Technical Specification.

19.16 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 19-1	Submit the proposed NEPP Phased Deployment Plan.	19.1	Within 30 days of NTP	Yes
CDRL 19-2	Submit the Installation and Interface Plan (IIP).	19.3.1	PDR, FDR	Yes
CDRL 19-3	Submit a Site Specific Work Plan (SSWP) for each station, bus facility, parking garage, and every other locations where work shall be performed as part of this contract.	19.3.3	PDR, FDR	Yes
CDRL 19-4	Submit a Site Specific Safety Plan (SSSP) for each station, bus facility, parking garage, and every other locations where work shall be performed as part of this contract.	19.3.4	PDR, FDR	Yes
CDRL 19-5	Submit all power requirements for the NEPP communications equipment.	19.3.7	Following NTP	Yes
CDRL 19-6	Submit all power requirements for the NEPP field devices.	19.3.7	Following NTP	Yes
CDRL 19-7	Submit documents and drawings detailing design and installation of NEPP equipment at each Metrorail Station.	19.3.8	CDR, PDR	Yes
CDRL 19-8	Submit documents and drawings detailing design and installation of NEPP equipment at Bus Facilities.	19.3.9	CDR, PDR	Yes
CDRL 19-9	Provide all mobile equipment installation plans and material lists	19.3.10	FDR	Yes
CDRL 19-10	Submit all power requirements for all components of the CDS.	19.3.11	Within 45 days of NTP	Yes
CDRL 19-11	Submit all power requirements for the NEPP Simulator Lab devices and submit the environment operating requirements for the Simulator Lab.	19.3.12	Within 45 days of NTP	Yes
CDRL 19-12	Submit the comprehensive test program plan inclusive of 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.	19.4.2	PDR	Yes
CDRL 19-13	Submit where required by WMATA, updated test procedures.	19.4.3	Within 15 days of test commencement	Yes
CDRL 19-14	Submit the procedures to be followed for the resolution of test problems, failures, inaccuracies, and general test conduct ground	19.4.3.1	Within 45 days of NTP	Yes

CDRL No.	Description	Section	Due	Approval Required
	rules of failure resolution.			
CDRL 19-15	Identify the tests for which waivers may be requested at the Conceptual Design Review, including all information 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.	19.4.3.2	Following NTP	Yes
CDRL 19-16	Submit the test plan for the CDS, network, and communication system, inclusive of all portions of the communications network, wired as well as wireless.	19.7	FDR	Yes
CDRL 19-17	Submit the test plan for the FAT Functional Test.	19.8	FDR	Yes
CDRL 19-18	Submit the test plan for the FAT Vibration Test.	19.8	FDR	Yes
CDRL 19-19	Submit the test plan for the FAT Shock Test.	19.8	FDR	Yes
CDRL 19-20	Submit the test plan for the FAT Electromagnetic Effects Test.	19.8	FDR	Yes
CDRL 19-21	Submit the test plan for the FAT Radiation and Electromagnetic Interference Test.	19.8	FDR	Yes
CDRL 19-22	Submit the test plan for the FAT Temperature/Humidity/Voltage Test.	19.8	FDR	Yes
CDRL 19-23	Submit the test plan for the FAT Water Intrusion Test.	19.8	FDR	Yes
CDRL 19-24	Submit the test plan for the FAT Dust Test.	19.8	FDR	Yes
CDRL 19-25	Submit the test plan for the First Article Enclosure Integrity.	19.8	FDR	Yes
CDRL 19-26	Submit the test plan for the FAT Maintainability Test.	19.8	FDR	Yes
CDRL 19-27	Submit the test plan for the FAT CDS Software Verification Test.	19.8	FDR	Yes
CDRL 19-28	Submit the test plan for the FAT System Interface Test.	19.8	FDR	Yes
CDRL 19-29	Submit the test plan for the FAT Application Verification Test.	19.8	FDR	Yes
CDRL 19-30	Submit the test plan for the FAT Cycling Test.	19.8	FDR	Yes
CDRL 19-31	Submit the test plan for the FAT Report Generation Test.	19.8	FDR	Yes
CDRL 19-32	Submit the test plan for the PAT	19.9	FDR	Yes
CDRL 19-33	Submit the test plan for the PIC	19.11	FDR	Yes
CDRL 19-34	Submit the Integration Test plan to verify that all NEPP components are fully integrated to perform as a	19.13	PDR	Yes

CDRL No.	Description	Section	Due	Approval Required
	single system for WMATA and ensure that all NEPP equipment can successfully process the smart media issued and/or processed by the all other equipment procured under each contract.			
CDRL 19-35	Submit the Equipment Maintenance Report format and sample.	19.14.4	Following NTP	Yes
CDRL 19-36	Submit a report providing the results of the Wireless Broadband POC inclusive of all information required to ensure that the NEPP devices in conjunction with the wireless broadband system demonstrates the ability to meet WMATA's requirements.	19.15	At the completion of the POC test	Yes

End of Section 19

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20 DOCUMENTATION, PARTS AND TOOLS

The Contractor shall provide detailed documentation and manuals for all NEPP equipment, devices, and software for the entire NEPP System provided under this contract. The information provided in these manuals and documentation shall permit WMATA to properly manage, operate, and maintain the NEPP System without support from the Contractor. The information provided shall permit WMATA to integrate equipment provided by other suppliers into the NEPP System without support from the Contractor. Such additional NEPP equipment shall include items such as station, vehicle and CDS equipment, and components.

The documentation and manuals shall provide detailed descriptions of functionality, step-by-step processes for performing each of the system functions, full information for the definition and meaning of all parameters and other specific items of information as further defined within this section, appropriate to each manual.

The Contractor shall coordinate all activities with WMATA to provide a comprehensive set of manuals and to update these manuals at each stage of NEPP System deployment to ensure that they are current and reflect the NEPP System as delivered.

Manual delivery shall follow the deployment phases as identified in Sections 1 and 19. For each of these phases, draft and final manuals and documentation shall be submitted by the Contractor to reflect the available functionality at each phase of deployment, as well as identify the changes that have occurred since deployment of the previous phase. Where documentation and manuals are not affected by the phasing, these shall not require any revision or additional deliveries by the Contractor.

At the conclusion of the final deployment phase, a final updated set of all manuals, both hardcopy and electronic source files, shall be provided to WMATA reflecting the final as-deployed configuration of the NEPP System.

20.1 General Requirements

All documentation provided for the NEPP System shall be presented in English and utilize English units of measurements as commonly employed in the United States. Unless otherwise specified, documentation shall be written for a reader having no more than a secondary school education.

Manuals shall provide easily understood directions and explanations and step-by-step instructions and shall include cross-references for all drawings, diagrams, and other illustrations referenced throughout the NEPP System documentation and manuals. Documentation and manuals shall be submitted directly to WMATA by the Contractor. Any materials received by WMATA from a third party will not be considered received and will not be reviewed by WMATA.

All documentation and manuals shall be provided both as printed hard copy publications and electronically as editable source files and secure PDF (Portable Document Format) files on DVD media. The electronic files shall include hyperlinks wherever possible (table of contents, index, etc.). The electronic media shall not be copy protected or encrypted in any way and shall not restrict WMATA in their use and/or edit of these documents to suit their operational and other needs after final system acceptance. The electronic documents shall be provided in two distinct forms:

A. Source files using a WMATA-approved version of Microsoft Office® suite;

B. Adobe Acrobat® pdf file format using the latest commercially available version of Adobe Acrobat for which an Adobe Acrobat Reader is available to the general public.

In the event that the Contractor elects to use alternate software, subject to WMATA approval, five copies of the alternate software with full licenses, shall be delivered to WMATA along with the first submittal of draft manuals.

Electronic versions of all final drawings, including the as-built drawings, shall be provided to WMATA by the Contractor with delivery of manuals at the end of each installation phase. **CDRL 20-1** These drawings shall be reissued with each phase of deployment to show engineering changes made to any component or module up to the end of the warranty period for the Contract.

Contractor shall update manuals as required over the life of the Contract to reflect all configurations operational in the field. All manuals shall be furnished as controlled documents and shall be serialized.

WMATA reserves the right to reproduce any submitted NEPP manuals in written or electronic form, drawings and documentation for its sole use and purpose to maintain or operate the NEPP System.

20.2 Formatting of Manuals

Manuals shall be formatted as follows:

A. All manuals shall be sequentially numbered with a control number by type of manual;

B. All information judged to be of a sensitive nature by WMATA and/or Contractor for security reasons shall be identified as such no later than the Final Design Review and will be handled in a manner to be determined by WMATA **CDRL 20-2**;

C. All sections shall be tabbed and labeled properly;

D. Maintenance and Operations manuals shall be designed for continuous, long-term service. All covers shall be approximately 1/16 inch (2 mm) thick, resistant to oil, moisture, and wear, to a high degree commensurate with their intended uses. Durable materials for long time service in the maintenance shop environment shall be used;

E. Manuals shall lie flat when opened and shall permit adding and replacing pages. Each copy of the manual shall be bound in three or more ring or post loose-leaf binders with the title lettered on both the front cover and spine;

F. Reinforced ring holes shall be used in all pages, data sheets, catalogues or other documents, or alternatively all pages shall be enclosed in a three-hole punched clear plastic sleeve;

G. If manual is in more than one volume, the volume(s) shall be appropriately numbered under the title, wherever it appears;

H. The standard size manual shall be 8-1/2 inches by 11 inches with a maximum overall thickness of three inches per manual volume. Schematics, diagrams, illustrations, and drawings may be provided in either 8-1/2 x 11 inches or 11 x 17 inches sizes. The 11 x 17 inch size shall be folded and bound to conform to the 8-1/2 inch x 11-inch format. Folded sheets shall display identification on the last fold, readable without unfolding;

I. Final sets of manuals shall be serialized with numbers to be supplied by WMATA. The numbers shall be permanently marked on the spine of the cover;

J. Loose-leaf metal binder rings with locks shall be used to prevent undesired opening and to provide positive engagement when closed. Diagrams and illustrations shall not be loose or in pockets;

K. All printed materials shall be clearly reproducible by dry copying machines. This precludes the use of photographs and half-tone illustrations in any manual or training material delivered to WMATA under this Contract;

L. Line drawings, including exploded isometrics and three dimensional outline drawings shall be provided in order to provide an easy reference for locating controls, displays, panels and other items or components on a unit of equipment;

M. Contractor shall supply WMATA with electronic copies of all images. Where appropriate, these digital images shall include labels and indicators (such as arrows) for identification purposes to individual equipment and component elements; and

N. Information for drawings and illustrations shall include; block diagrams, entity relationship diagrams, exploded views, illustrated parts breakdowns, and schematic drawings to facilitate descriptions of assemblies and the relationships of components, subsystems, and systems.

20.3 Documentation Development

All documentation shall be developed as progressively more detailed drafts with sufficient information to support interim activities, as outlined below.

The organization of the manuals shall treat the NEPP System as an integrated system and not as a grouping of disassociated components. The manuals shall highlight the precautions to be taken by operating and service personnel to assure their safety while operating NEPP equipment and performing maintenance and servicing operations.

Manuals furnished under this Contract shall be complete, modern, thoroughly organized, and authentic with no extraneous or irrelevant information and shall use a standard numbering system. The numbering of the sections shall be consistent from one type of manual to another to allow easy cross-referencing among different manuals.

Each section of each manual shall be subdivided, to the extent required by the subject matter, into the same chapters, to facilitate looking up specific topics or tasks. Coverage of the chapters shall include the following topics:

- General NEPP equipment description and operation, including how the device fits into the NEPP System and interfaces with other devices and subsystems;
- Block diagrams;
- Functional schematics;
- Functional wiring and piping diagrams;
- Troubleshooting techniques;
- Microprocessor software;
- Lubrication and cleaning, including frequency, methods and trade identifications of recommended materials, component location and description;
- Inspection and maintenance standards including wear limits, settings, and tolerances;
- Installation and removal; and
- Test and evaluation procedures.

Upon WMATA's approval of the Contractor's first manual submittals, the manuals shall be considered as "Interim Manuals" until acceptance of the final phase. Following the issue of each Interim Manual, the Contractor shall provide revised pages covering any changes, whether required by change of design or procedures or due to error, and these revisions shall be kept current during the term of the Contract up to and including the completion of the operation, maintenance and warranty requirements of the Contract. Manual and catalog revisions shall be supplied to WMATA before or coincidental with the arrival of the altered parts or components.

A new status sheet listing the effective dates of each page shall be included for each manual at the time updates are forwarded to the WMATA. Each updated page shall be annotated with a vertical bar in the margin to identify where material has been added, deleted, or revised.

20.3.1 Manual Outlines

The Contractor shall provide a detailed outline of each manual, stating its objective, audience and containing a discussion of each topic or chapter and sub-topics and their contents at CDR. **CDRL 20-3**

20.3.2 Preliminary Draft Manuals

Preliminary drafts of manuals shall be supplied for WMATA review and comment at FDR. **CDRL 20-4** These manuals shall be as complete and as comprehensive as possible and shall include within their contents listing all sections and subsections to be included within the final manuals. This shall permit WMATA to identify missing information upon their review of the preliminary drafts. Three hard copy sets and one electronic copy set of each type of document, manual and drawing as described in this section shall be supplied as preliminary drafts for review and comment by WMATA. WMATA's comments will be provided to the Contractor at the commencement of the First Article Test (FAT). These draft manuals shall be provided for the initial deployment phase only.

20.3.3 Final Manuals

Complete final versions of the manuals shall be delivered by the Contractor for WMATA review and approval no less than 45 days prior to the deployment of the devices and commencement of revenue service for the NEPP System. Three hard copy sets and one electronic copy set of each type of manual as described in this section shall be supplied for WMATA review and comment. After WMATA approval of the manuals, they shall be delivered in the required quantities as defined by Section 20.4 and shall be without identification of any changes or markups. **CDRL 20-5**

20.3.4 Final System Manuals

The final NEPP System manuals shall have incorporated all modifications or changes made to any part of the NEPP System, based on the final design and agreements reached through the completion of the First Article Test (FAT) for the final deployment phase.

Three hard copy sets and one electronic copy set of each type of manual as described in this section shall be supplied for WMATA review and comment. The documents shall not be considered complete and acceptable until WMATA has reviewed all documentation and the Contractor has updated the manuals and documentation to completely reflect the final system operation. After WMATA approval of the manuals, they shall be delivered in the required quantities as defined by Section 20.4 and shall be without identification of any changes or markups. **CDRL 20-6**

The warranty period for the NEPP System and any equipment contained as part of the NEPP System shall not commence until complete and final documentation, submittals and manuals, as specified herein, have been furnished by the Contractor and accepted by WMATA.

20.3.5 Revisions

All manual revisions shall be recorded on a control list in the front of each manual. The list shall be updated and reissued by the Contractor with each revision. The record of a revision shall provide a sequential reference number, identify the nature of the change, the date of the revision, and page references of the revisions. The Contractor shall continue this until the warranty period expires. Revisions shall be prepared and submitted prior to the arrival of revised components or software to which the revision refers and immediately after relevant procedures are changed or errors are found and corrected.

Electronic versions of all drawings shall be provided to WMATA by the Contractor with delivery of final manuals. These drawings shall be reissued with each revision to show engineering changes made to any component or module up to the end of the warranty period for the contract. **CDRL 20-7**

20.4 Required Manuals

The Contractor shall provide manuals by phase of deployment as identified in this Section in the quantities shown in Table 20-1.

Table 20-1 – Required Quantity of Manuals

Manual	Quantity
NEPP Systems Operations Manuals	
NEPP System Overview Manual	25
Management of Smart Media and WMATA Accounts	25
Fare Vending Device Operations Manual	50
Fare Gates Operations Manual	50
Platform Validator Operations Manual	25
On Board/Bus Payment Target Operations Manual	25
Sales Device Operations Manual	25
Central Data System Operations Manual	25
Closed Circuit Television Operations Manual	25
Parking Operations Manual	25
On Board/Bus Payment Target Mobile Operator's Manual	2,200
Rail Handheld Validator Mobile Operator's Manual	500
Parking Handheld Validator Mobile Operator's Manual	50
Revenue Service of NEPP Equipment	25
Cash Room Operations Manuals	5
Revenue Reconciliation of NEPP Equipment	5
Security Manuals:	
NEPP System Security Manual	5
Maintenance Manuals:	
Field Maintenance Manual	50
Shop Maintenance Manual	25
Special Tools Manual	10
Illustrated Parts Manual	5
Integrated Schematics and Wiring Diagrams	5
Bill of Materials	5
NEPP CDS Manuals:	
Hardware Manuals	5
Application Documentation	5
System Administrator/User Manual	5
Database Management Manual	5

20.4.1 NEPP System Operations Manuals

20.4.1.1 NEPP Systems Overview Manual

The NEPP System Overview Manual shall include a general overview of the entire NEPP System and all of its devices and functionality. This shall include general information on all of the system devices including performance characteristics, dimensions, communications protocols, and capacity.

Illustrations shall show device configurations as well as the location of all systems and subsystems of the NEPP System. To the greatest extent possible, layout illustration views shall be in perspective, with suitable cutaways to clarify equipment locations. The use of two-dimensional drawings shall be minimized. The manuals shall also provide a general description of the test and inspection equipment and special tools.

20.4.1.2 Smart Media and Account Management

The NEPP Manual for Management of Smart Media and WMATA Accounts shall provide detailed instructions on the methodology and systems by which WMATA shall manage all types of Smart Media as well as WMATA's accounts associated with the Smart Media.

In addition, the manual shall incorporate step-by-step instructions on how to assist Customers utilizing the Customer Support Center functionalities provided in Section 22.

20.4.1.3 Equipment Operations Manuals

Equipment Operations Manuals shall be provided for each type of NEPP equipment and computer system provided as a part of the overall NEPP System. These manuals shall contain information needed to obtain an understanding of how the customer-operated equipment functions as well as how the WMATA-operated equipment functions. This manual shall be written for use by operations, revenue servicing and supervisory personnel. The following are sample section topics as an example of the type of Information that shall be included:

A. General system description and familiarization material;

B. Screen shots of all screens;

C. All customer displayed information;

D. Screen flow diagrams;

E. All operator displayed information;

F. Customer operation and Interfaces;

G. Safety features;

H. Stocking of coins and Smart Media;

I. Location, function, and operation of pertinent controls, indicators, and switches;

J. Setup and shutdown procedures.

In addition to the above, operations manuals shall incorporate step-by-step instructions to assist passengers with the normal operation of the equipment and resolving operational problems. These descriptions shall be supplemented with line drawings, including exploded isometrics and three dimensional outline drawings, to depict the resolution of passenger difficulties and equipment malfunction.

20.4.1.4 Mobile Device Operator's Manual

The Operator's Manuals for mobile equipment (HSDs, OBPTs, etc.) shall be pocket size and printed on plastic coated paper, or the equivalent as approved by WMATA, for portability and durability. The operator manual shall be no more than 3-1/4 inches wide by 6 inches high and no more than 1/4 inch thick. This manual shall provide step-by-step operation of the mobile devices to permit WMATA's Smart Media to be properly processed.

20.4.1.5 Revenue Service of NEPP Equipment

The Manual for Revenue Service of NEPP Equipment shall include all necessary information to perform revenue service of all NEPP equipment, including media stock replacement, off-line data collection, cash container exchange and all other revenue servicing operations required to ensure revenue security and accountability.

20.4.1.6 Cash Room Operations Manual

The Cash Room Operations Manual shall include all information necessary to properly and safely operate all Cash Room equipment provided under the Contract.

20.4.1.7 Revenue Reconciliation of NEPP Equipment

The manual for Revenue Reconciliation of NEPP Equipment shall provide an understanding and instructions for balancing the collected revenues against sales for each type of NEPP equipment. The manual shall also cover reconciliation of revenues from Cash Room equipment as well as credit/debit sales reports to ensure that the NEPP System can be fully reconciled. The manual shall include instructions on understanding the revenue container reports issued by the NEPP Smart Media sales equipment, balancing all monies, credit card usages and debit card usages, and settlement of accounts.

This manual shall be identified as “CONFIDENTIAL” and treated accordingly in NEPP System development and documentation distribution as identified by WMATA.

20.4.2 Maintenance Manuals

The Contractor shall provide maintenance manuals covering both field maintenance and shop maintenance for all types of NEPP equipment and software. Each manual shall include drawings, which identify the various parts and assemblies in the equipment. The manuals shall identify all special tools required for any of the procedures.

Each type of maintenance manual shall contain, but not be limited to a description of operation; installation procedures; a complete parts identification diagram and list; troubleshooting procedures; inspection procedures; preventive maintenance procedures and schedule; repair procedures; diagnostic procedures and routines; descriptions of internal diagnostics; wiring diagrams; electrical schematics with board and cable identification; and adjustment procedures.

20.4.2.1 Field Maintenance Manual

A Field Maintenance Manual shall be developed that contains all information needed to enable maintenance technicians to perform all necessary maintenance tasks, both corrective and preventive, for the NEPP equipment installed at any WMATA-defined location. This manual shall cover:

A. Periodic inspections;

B. Preventive maintenance activities;

C. Preventative maintenance schedules for each type of NEPP equipment;

D. All information needed to diagnose problems and make adjustments, corrections and repairs in the field.

The manual shall include, at a minimum: a general description of each subsystem, component, and subassembly; functional block diagrams; detailed schematics; and wiring diagrams.

The Field Maintenance Manual shall also include references as needed for using portable test equipment (PTE), bench testers, and shop test stands for maintenance, adjustment, test, and troubleshooting functions in support of various maintenance procedures.

20.4.2.2 Shop Maintenance Manual

A Shop Maintenance Manual shall be provided that includes all information needed to enable maintenance technicians to perform all necessary maintenance tasks such as overhaul, corrective and preventive for the Lowest Level Replaceable Units (LLRUs); including assemblies, sub-assemblies and components of all types of NEPP equipment. All information required to bring an LLRU back into operation shall be incorporated into this manual, including:

A. Detailed instructions on workbench preventive maintenance requirements and procedures as needed to enable maintenance technicians to perform all periodic inspection and higher-skilled preventive maintenance tasks;

B. Recommended bench-level PM schedules for each type of NEPP equipment and LLRU;

C. All information needed to diagnose problems and make adjustments and work-bench repairs in a WMATA maintenance facility on all NEPP System components and sub-assemblies;

D. All information needed for in-shop repair and trouble diagnosis of the lowest replaceable component on the LLRU;

E. A detailed analysis of each LLRU within the NEPP System so that maintenance technicians can effectively inspect, troubleshoot ,maintain, adjust, repair and overhaul it;

F. Recommended overhaul schedules for each type of NEPP equipment and LLRU.

In support of the shop maintenance activities to be performed, the Shop Maintenance Manual shall contain for each LLRU and for each type of NEPP equipment:

A. Detailed flow charts or approved equivalents;

B. Exploded parts diagrams and schematic drawings;

C. Detailed analyses;

D. A detailed troubleshooting section, which expands upon the information provided in the Field Maintenance Manual.

The Shop Maintenance Manual shall also include references as needed for using portable test equipment (PTE), bench testers, and shop test stands for maintenance, adjustment, test, and troubleshooting functions in support of various maintenance procedures.

20.4.2.3 Special Tools Manual

The Special Tools Manuals shall provide step-by-step instructions for operation, adjustment, maintenance, troubleshooting, and data storage of all of the special tools, devices and test equipment used in support of maintenance, operation, and expansion of the NEPP System. The manuals also shall contain replacement parts information.

These devices shall include those special tools/devices, which provide for coin and bill adjustments and acceptance as well as the accompanying software.

20.4.2.4 Illustrated Parts Manual

The Illustrated Parts Manual shall describe and identify each module, sub-assembly, and part within each piece of equipment with its related supplier identification number and Contractor identification number. Exploded drawings shall be provided to permit identification of all parts not readily identified by description.

The Contractor shall provide a parts layout for every printed circuit board, specifically calling out each component, be it mechanical or electrical in nature, and showing its exact location.

20.4.2.5 Integrated Schematics and Wiring Diagrams

Totally integrated NEPP System schematics relating to all NEPP devices and systems shall include device and component identification, component values, waveforms, voltages, currents, resistance values, wire identification and connector identification. All components on PC boards shall be individually shown in the schematics. Schematics shall be comprehensive in nature and thoroughly detailed to permit use by WMATA's shop maintenance staff to troubleshoot and repair NEPP System components.

Integrated-wiring diagrams shall be provided for each type of equipment, and shall include the following drawings:

- Location in schematic and schematic designation;
- Type, model, and part number;
- Location on NEPP System component;
- Function;
- Schematic symbol;
- Appropriate ratings data;
- Interface information, as appropriate;
- Pin-to-pin connector terminal designations and wire designations at both sides of each connection for connectors and terminal blocks;
- Subsystem-level wiring diagrams and schematics for each subsystem. The diagrams shall be compatible with the schematics;
- Drawings showing the location of all traces on the top and bottom and any through board connections of each printed circuit board.

20.4.2.6 Bill of Material

A complete Bill of Material (BOM) shall be provided for each type of equipment prior to manufacture of any equipment for the NEPP System. The BOMs shall include a unique part number, description, generic name and generic part number for each component in the NEPP System.

Diagrams and drawings shall identify each system component and shall call out each component with the unique part number as referenced in the BOM. Sub-component detail of commercial equipment such as computers and peripherals, at the discretion of WMATA, may be limited to board or major component level. This information shall be provided fifteen (15) days prior to the commencement of any installation. **CDRL 20-8**

20.4.3 NEPP CDS Manuals

The Contractor shall provide the following manuals for each CDS component and sub-system as defined below.

20.4.3.1 Hardware Manuals

The Contractor shall provide Hardware Manuals, to include drawings, which identify the various parts and assemblies of the computer and server systems. The manuals shall contain start-up procedures, operating modes, interconnection diagrams, preventive maintenance procedures and programs, diagnostic procedures, and wiring diagrams with board and cable identification.

The manual shall also include those instructions, which are connected with each type of peripheral and component of the CDS as found in the standard manufacturer's information.

20.4.3.2 Application Documentation

The Contractor shall provide complete documentation for each Contractor developed and furnished application for the NEPP System, the CDS, and any other subsystems with a microprocessor or microcomputer incorporated. This documentation shall be written for a reader having a post-secondary education appropriate for computer technicians and other similar personnel.

The documentation provided shall also identify all third-party software integrated and/or interfaced to the NEPP System software and shall include the version implemented. Software version information shall be provided for each manual and each software modification, which causes a change in the reported software version, shall be fully documented and this information incorporated.

The documentation for each version of Contractor developed and furnished application shall be complete and comprehensive to include, but not be limited to complete source code listings with fully documented statements; comprehensive flow charts; and block diagrams explaining the system as a whole and showing how the individual programs are interrelated.

Of particular importance are the software interfaces between the NEPP System elements, including data fields and definitions of the messages transferred as well as the interfaces between the Contractor-developed software and the third party software. These shall be fully defined, documented, and included in the appropriate manuals.

The software documents shall clearly identify what data elements are stored, the source of each data element, how data is structured, transferred and utilized. This shall include the software logic, processing rules, restrictions and exceptions, default conditions and hard and soft-wired parameters.

20.4.3.3 System Administration/User Manual

The Contractor shall provide a user manual containing detailed operating instructions and procedures to be used for all CDS functions. Information in the manual shall be presented in terms that are meaningful to users. The manual shall include a system operation description (hardware and software) as it relates to the user's tasks. This manual shall also include complete operational and troubleshooting information on all interfaces to third party systems and between two subsystems.

Procedures shall be step-by-step with an explanation of how each step is performed, what parameters can be adjusted, and the effects resulting from varying each parameter. All user guidance and error messages shall be described, along with the steps necessary for recovery from error and troubleshooting guidance. This document shall also address all alarms, events, status messages, transaction formats and contents, and all communications by the CDS.

This documentation shall be provided using language appropriate to computer operations and professionals and other similar personnel.

20.4.3.4 Database Management Manual

The Contractor shall provide a complete manual on all aspects of operation of the database on the system. This will include a Contractor prepared manual that describes how to use the system, its databases and all available reports, macros, menus and other elements of the Contractor provided programs. Data fields, data formats, a detailed data dictionary, and other information required for a complete and thorough understanding of all database structures and contents shall be provided.

This information shall also include the inter-relationships of database tables.

This documentation shall be provided using language appropriate to computer programmers, database administrators, and similar personnel.

20.4.4 Security Manual

To the greatest extent feasible, the Contractor shall not include in any of the documentation items related to the specific operations of, and/or maintenance of, security devices which may be used for fraudulent purposes or whose disclosure may compromise system integrity and revenue security.

Information of this type as identified at the Final Design Review and submitted separately, shall be clearly stamped CONFIDENTIAL in bold capital letters. **CDRL 20-9** It shall be the Contractor's responsibility to verify with WMATA's Project Manager what information shall be considered confidential.

WMATA regards the documentation for the CDS programs, the hardware and software constituents of the money handling systems, and certain aspects of maintenance, constructional information and other similar elements to be security related and to be confidential.

WMATA will provide the Contractor with a list of those items to be included in the Security Manual and removed from other manuals, based on the information received as part of the manual outlines received at the Conceptual Design Review and through the Final Design Review. If additional information is identified after the Final Design Review, WMATA reserves the right to request additional changes to the contents of the Security Manual prior to the delivery of the final manuals.

20.5 Parts and Tools

20.5.1 Recommended Spare Parts

Spare parts shall be functionally interchangeable with their corresponding parts provided in the original equipment deliveries. All delivered spare parts in inventory shall conform to the latest functional version during the warranty period. However, in the case of upgrades that provide an increase in functionality and are not implemented to meet the performance requirements of this contract, existing spare parts inventory shall not be upgraded.

The Contractor shall have available at least two U.S. sources for all spare parts and consumables that are exchanged regularly during preventive maintenance, except Contractor designed spare parts. The Contractor shall also endeavor to have other spare parts available from two U.S. sources.

Packaging of spares and consumables shall consider the reliability of the parts and the requirements for inspection and inventory (e.g., the packaging selected for highly reliable parts shall be such that the parts can be identified, inspected, stored for long periods, and endure multiple inventory cycles).

20.5.1.1 Spare Parts Lists

The Contractor shall provide a complete list of recommended spare parts, as identified below. This list shall not include lump sum categories; where miscellaneous spare parts are included in a single entry. All spare parts shall be separately identified and priced. Spare parts recommendations shall include the following:

A. Grouping by type (including diagnostics and test equipment), subsystem, and special tools, as applicable, for stocking identification;

B. Generic name, trade name, description, rating, accuracy, Contractor's part number, contract price, manufacturers' names and part numbers (at least two manufacturers), drawing references, and correlation with the maintenance manuals;

C. Price;

D. Correlation of the recommended quantities with reliability requirements and lead time on the basis of the following classifications:

1. Wear - parts that may be expected to require regular replacement under normal maintenance schedules, such as mechanical parts subject to continuous operation;

2. Consumables - parts with an expected life of less than 5 years, such as indicator lamps;

3. Single Use - parts that normally require replacement after performing their function one time, such as fuses;

4. Long Lead Items - parts that are not readily available from distributors or the manufacturer, such as specially made components;

5. Exchange Assemblies - assemblies that will be exchanged with failed units (or units that are not responding as specified) on the supplied equipment and that must be inventoried as complete assemblies.

A cross-reference and indexing system shall be provided for replacement components common to more than one subsystem (whether NEPP equipment, diagnostics and test equipment, or special tool). Such components shall have only one part number. All part numbers shall correspond to numbers for such components in the Illustrated Parts Manual.

20.5.1.2 Recommended Consumable Parts

For the purposes of this Section, consumable parts shall be defined as those parts that are routinely replaced as part of the preventive maintenance of the NEPP System equipment, and that once replaced are not expected to be used again.

The Contractor shall furnish a list of recommended consumable parts necessary to properly maintain the NEPP System equipment for a three-year period, consistent with the Contractor's recommended maintenance practices. This list shall be updated as the Contractor's design progresses and shall be finalized as part of the Final Design Review. **CDRL 20-10** Consumption rate data and data on lead-time for procurement shall be made available to WMATA in support of these consumable parts recommendations.

20.5.1.3 Recommended Replacement Parts

For the purposes of this Section, replacement parts shall be defined as those parts that are not routinely replaced as part of the preventive maintenance of NEPP System equipment, but that are reasonably expected to require replacement from time to time due to random failure.

The Contractor shall furnish a list of recommended replacement parts necessary to properly maintain the NEPP System equipment for seven years, consistent with the Contractor's recommended maintenance practices. This list shall be updated as the Contractor's design progresses and shall be finalized as part of the Final Design Review. **CDRL 20-11** Consumption rate data and data on lead time for procurement shall be made available to WMATA in support of these replacement parts recommendations.

20.5.1.4 Recommended Repair Parts

For the purposes of this Section, repair parts shall be defined as those parts that are not routinely replaced as part of the preventive maintenance of the NEPP System equipment, but that are reasonably expected to require replacement from time to time due to external causes such as vandalism, abuse, or accident.

The Contractor shall furnish a list of recommended repair parts necessary to properly maintain the NEPP System equipment for seven years. This list shall be updated as the Contractor's design progresses and shall be finalized as part of the Final Design Review. **CDRL 20-12** Data on lead-time for procurement of repair parts shall be made available to WMATA in support of these repair parts recommendations.

20.5.1.5 Recommended Overhaul Parts

For the purposes of this Section, overhaul parts shall be defined as those parts that are expected to be replaced at planned intervals, typically as part of a Scheduled Maintenance Program, and that once replaced are expected to be remanufactured, overhauled, or reconditioned for further use.

The Contractor shall furnish a list of recommended overhaul parts to support a continuous, ongoing overhaul program to ensure proper NEPP equipment functionality for each NEPP component, consistent with the Contractor's recommended maintenance practices. This list shall be updated as the Contractor's design progresses and shall be finalized as part of the Final Design Review. **CDRL 20-13**

In the case of components that normally receive only a mid-life overhaul, the Contractor shall consider the likelihood of future technological obsolescence in making its recommendations. Consumption rate data and data on lead time for procurement shall be made available to WMATA in support of these overhaul part recommendations.

20.5.1.6 Inventory

The Contractor shall provide WMATA with an inventory of spare parts as selected by WMATA upon review of the recommended spare parts list provided by the Contractor at the Final Design Review. **CDRL 20-14** This spare parts inventory shall be delivered and stored at WMATA-approved sites.

Prior to associated devices and equipment being placed in revenue service, WMATA shall stipulate the minimum parts inventory required to be provided by Contractor at the aforementioned site. A schedule for the delivery of the balance of spare parts shall be provided by Contractor is subject to approval by WMATA no less than 30 days prior to commencement of installation.

WMATA will make these parts available to the Contractor for repair of WMATA equipment during the system test and warranty period provided the Contractor maintains an adequate balance of parts and promptly replaces all parts consumed or rendered inoperable for Contractor-required warranty and maintenance work. The Contractor assumes responsibility for these parts while they are in the custody and control of the Contractor.

The Contractor shall maintain the entire inventory of spare parts and return to WMATA the full quantity purchased by WMATA in good working condition and upgraded to the latest functional version to meet the performance requirements of this contract at the conclusion of the warranty period. The Contractor shall be reimbursed for replacement spare parts that have been documented by the Contractor and approved by WMATA as having been used for repair of vandalism.

This inventory shall be replenished to its original complement at the conclusion of the warranty period.

20.5.2 Listing of Sources

The Contractor shall provide a listing of sources for purchasing components and parts that are commercially available, other than from the Contractor. Components and parts not so listed shall be considered by WMATA to be proprietary and available by single source. This information shall be provided 15 days prior to the commencement of any installation. **CDRL 20-15**

20.5.3 Tools, Test and Inspection Equipment

The Contractor shall provide a list of all special or custom tools or instruments required to install, maintain, or adjust any component in the NEPP System. The Contractor shall also provide all test and inspection equipment necessary for maintaining, troubleshooting, testing, repairing, calibrating and inspecting all NEPP System equipment. This shall include equipment for the support of back shop repair activities, and for field inspection and test of equipment as well as a complete test bench for each type equipment included as part of the NEPP System.

Two sets of tools, test and inspection equipment shall be submitted to WMATA prior to the conclusion of the NEPP System warranty. The Contractor shall also provide a list of suppliers where supplemental special or custom tools or instruments can be purchased.

The list of special or custom tools, instruments, test and inspection equipment shall be provided for WMATA review at CDR and for WMATA approval at Final Design Review. **CDRL 20-16**

Should any modifications to the list be required at different phases in the program, Contractor shall notify WMATA prior to implementation of software or hardware, which would require such special tools.

20.5.4 Portable Test Equipment (PTE)

20.5.4.1 General

PTE shall be supplied for all NEPP System equipment, to aid WMATA's maintenance staff in maintaining, troubleshooting, and repairing the equipment.

Complete parts lists and schematic diagrams of the PTE and instructions concerning how to use them for their intended purpose shall be in the appropriate manuals described in Section 20.4.2.

For each system there shall be system specific software to be utilized by a common PTE laptop (or tablet PC). Cabling shall be standardized to perform testing for all NEPP System equipment.

It shall not be necessary to remove, dislodge, dismount, or disconnect any component, card, wire, chassis, terminal, or cable in order to perform periodic calibration, or trouble diagnosis while using PTE. The PTE shall include all cables, industrial grade connectors and associated equipment to interface with the test points.

20.5.4.2 Functional Requirements

The PTE shall have loaded and available electronic copies of all maintenance manuals to facilitate maintenance technician inspection and repair of NEPP System equipment.

The PTE shall be able to produce all of the operating commands and other input signals necessary to fully exercise all functions and components of the particular system or subsystem under test, and to measure or indicate all of the signals, responses and outputs produced by a system by means of indicators such as lamps, meters, oscilloscopes, or gages. It will be acceptable to require a visual check for system response such as closure of a contactor, provided that the responding item of equipment does not require removal of other equipment or use of hand tools to permit observation of response, and does not require the maintenance technician to move more than 15 feet to make the required observation.

When used according to the instructions supplied by the Contractor, each PTE shall enable the maintenance technician to fully check and calibrate the system or subsystem under test and to locate and replace any removable component which has fully or partially failed. Response indicators and input-signal generators shall be built into the PTEs to the maximum extent possible, and shall have accuracy commensurate with the alignment tolerances specified.

20.5.4.3 Physical Requirements

PTE shall perform under the environmental conditions imposed by the activities of the NEPP System equipment field environment and repair facility. PTE shall be portable and suitable for industrial service for use on the shop floor, station environment, and use in the bus yard. The test equipment shall be self-protected in the event of an overload or short circuit condition.

The laptop PC PTEs shall, as a minimum, be state of the art at time of delivery and shall include RAM and hard storage capable of storing all system and subsystem test software and fault log downloads from an entire work shift.

Each PTE shall be housed in an aluminum or fiberglass suitcase-type enclosure with a removable cover suitable for use in a shop environment and as manufactured by Zero Manufacturing Co., Skydyne, or approved equal. All meters supplied as part of the PTEs shall be of a variety capable of withstanding industrial service.

The weight for any PTE shall not exceed 10 lbs. without the prior approval of WMATA.

20.5.4.4 Cables

External hook-up multi-conductor cables shall be furnished to connect the NEPP System equipment with the PTE. A minimum number of cable connections shall be used to connect the test equipment to the systems under test. Cables shall be flexible, abrasion resistant, and oil resistant. The connecting cables and hoses shall be stored within the PTE case.

The Contractor shall not require connection of external apparatus to the PTEs without the prior written approval of WMATA. In such cases, terminals shall be provided to allow connection of the required apparatus to the PTEs. However, such apparatus shall be considered part of the PTEs and shall be supplied with it on a one-to-one basis.

20.5.5 Maintenance Support Device

The NEPP System shall include a Maintenance Support Device (MSD) to assist WMATA maintenance personnel with corrective and preventive maintenance. The MSD shall provide support for the maintenance of the NEPP System. This support shall include, but not be limited to, work order processing and storage, and display of information from the maintenance and operational manuals. The MSD shall:

- Obtain health and status information from all equipment located at a station, via the wireless data network;
- Accept work order information from the NEPP, via the wireless data network at a station, Bus Facility or other maintenance location within range of the wireless data communication system;
- Read bar coded information on the equipment and spare parts and store and transfer this information as required by WMATA to support the NEPP;
- Interface with every type of NEPP equipment and perform diagnostic routines and identify equipment problems;
- Permit the maintainer to enter all necessary data to complete the work order, to close the work order and transfer the data to the NEPP;
- Store and display, for maintainer review, the information in the maintenance and operations manuals; and
- Via the communications network, interface with the library workstations as specified in Section 20.6 to obtain updates to the maintenance and operational manuals.

20.5.5.1 Hardware Requirements

To ensure proper operation and the ability to support the needs of the NEPP System, the MSD shall:

- Be industrial grade equipment;
- Be designed for use in an industrial environment;
- Be provided with a rugged storage case for easy transport;

- Accept and store data through the use of a touch screen;
- Incorporate a bar code reader to read identification tags of equipment (see Section 6) and store this information in the electronic work order information for transfer to the CDS. Code 39 symbology;
- Incorporate a Payment Processing Target, as identified in Section 3, as a peripheral or integral element of the MSD, based on the processing unit employed;
- Provide an interface common to all NEPP equipment to permit diagnostics to be run and maintenance data to be gathered; and
- Accommodate additional third party peripherals as required to expand the functionality as desired by WMATA.

The Contractor shall provide details on all hardware elements of the MSD to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 20-17**

20.5.5.2 User Interface

The MSD display shall provide users with instructions, prompts, and transactional information. The display shall be a touch screen display with a minimum 11-inch (as measured diagonally) viewing surface. The MSD shall be easily read under all conditions of ambient light throughout the day and night. It shall provide for a full-page view of the information within a manual.

Displayed messages shall be easily modifiable by WMATA once the system is in operation. All prompts, instructions, displays, message formats, sample character fonts, and contents shall be subject to WMATA review at the Preliminary Design Review and approval at the Final Design Review. **CDRL 20-18**

20.5.5.3 Electronic Control Unit

For the Electronic Control Unit (ECU), which controls all aspects of the MSD, a microprocessor-based system shall be provided to control all functions. The microprocessor shall be commercially available and specifically designed for its intended use, that being continuous operation in the specified environment.

The ECU shall have sufficient RAM to avoid the use of virtual memory as a means of temporarily supplementing RAM during normal operations. The ECU shall permit plug-in upgradeability to double the amount of memory initially supplied, including memory for both primary and redundant data storage.

20.5.5.4 Software Requirements

The MSD shall provide the following functionality, as a minimum:

- The MSD shall not be operational until a proper log-on has been made to the MSD by a valid user. To activate the MSD for use, the user shall log-on to the device with, as a minimum, a username, and password. Smart Media may also be used as part of the log-on process but a portion of the log-on shall require data entry by the user, for security purposes;
- All data entered into the MSD shall be stored as part of a transaction record (e.g., maintenance record, diagnostics record, work order);
- All data and activity performed after user log-on but before log-off shall be assigned to that user;
- Maintainer shall be able to enter and review work order information assigned to that maintainer. Maintainer shall also have the opportunity to update work orders and create new work orders, based on privileges defined by WMATA for each maintainer or group of maintainers;
- Work order information shall be transferred between the CDS and the MSD when a connection can be made through the wireless data network;
- All data stored in the MSD shall be transferred to the CDS when the MSD is returned to one of the central maintenance locations identified by WMATA.

Contractor shall provide details on all software elements of the MSD to WMATA for review at the Preliminary Design Review and for approval at the Final Design Review. **CDRL 20-19**

20.5.5.5 Power Requirements

The MSD shall utilize one or more portable batteries to power the device. These batteries shall provide power to operate the MSD for not less than ten continuous hours, with any backlight activated not less than 50% of the time. Battery recharging shall take place in charging/data cradles while the batteries are located in the devices.

When the MSD has been inactive for a WMATA-adjustable period (initially set to five minutes), the MSD shall revert to a sleep mode requiring depression of a designated key to activate each unit. User log-on shall not be again required if the MSD is in the sleep mode as described below.

A sleep mode shall be provided, which after a WMATA-adjustable period in that mode (initially set to 30 minutes), the MSD shall shut down completely, and shall require the user to log on to the MSD after restoring power.

It shall not be necessary, but it shall be possible, to remove the batteries from the MSD to perform recharging. Full recharging of batteries shall require no more than six hours. Batteries shall not hold a recharging memory (i.e., batteries shall be able to recharge at any time for any length of time without deteriorating the recharging life of the battery).

As a minimum, two sets of rechargeable batteries shall be provided for each MSD. All required hardware for recharging the MSD using a standard 110VAC outlet shall be provided for each MSD.

20.5.5.6 Data Communications

The MSD shall communicate with the CDS to suit the needs of the NEPP System. This shall include, as a minimum, communication:

- Via the Wireless Broadband System;
- Via the Local Wireless System; and
- Via a direct, wired connection to the NEPP System network.

The Wireless Broadband System and Local Wireless System are outlined in Section 15. The MSD shall be equipped to handle communications with any of the above communications methodologies at any time. In the event both wireless and wired communications methods are available concurrently, the MSD shall automatically defer to wired communications.

20.5.6 Simulator Lab

A Simulator Lab shall be provided for the NEPP system. The NEPP Simulator Lab (NEPP SL) shall consist of, at a minimum, three mezzanines. Each Simulator Lab mezzanine shall include at least one operable item of each type of NEPP equipment and three fare boxes. The NEPP SL shall include an additional full CDS. The NEPP SL shall be installed at a WMATA designated location. **CDRL 20-20**

The NEPP SL shall not be used by the NEPP Contractor for training purposes.

Associated cabling and control systems shall be provided to permit the equipment to be activated as a complete NEPP system and to permit testing of all functions as identified in these specifications as well as training WMATA personnel by WMATA-designated personnel.

The NEPP SL shall also be used to observe and verify the operation of NEPP devices and interactions between NEPP devices as updated versions of software are deployed within the NEPP System. The NEPP SL shall be used to perform an exhaustive pre-revenue service test for each new NEPP device functionality and each new software version prior to deploying these in the live NEPP System service environment.

All problems and errors identified during the pre-revenue service tests of devices and software shall be corrected and verified as correct prior to the installation of the function and/or software into revenue service. In addition, the pre-revenue testing shall include regression testing to ensure that the updated functionality does not adversely impact any other pre-deployed function.

The design and layout of the NEPP SL shall be subject to WMATA review at the Preliminary Design Review and WMATA approval at the Final Design Review.

20.6 Technical Documentation Library Workstations

Windows® based library workstations shall be supplied by the Contractor to support WMATA's maintenance of documentation associated with the NEPP System inclusive of all manuals, drawings, schematics, and training materials. Delivery of all library workstation equipment shall coincide with the delivery of DVDs of the final manuals and catalogs. The library workstations shall be able to interface with the Maintenance Support Device, specified in Section 20.5.5, for transfer of maintenance and operational information, including updates of the operations and maintenance manuals.

The library workstation equipment shall enable WMATA's personnel to view manuals and drawings on DVD, including all manuals, training materials and documentation defined in Sections 20 and 21. WMATA personnel shall also be able to review and make revisions to the source files of all NEPP System electronic documents. The library workstation shall be delivered preinstalled with all necessary software (including all necessary licenses) to support WMATA's ability to store, manage, review, modify and print all documentation delivered under the NEPP System Contract.

Each library workstation shall be a state-of-the-art Windows-based PC as available at the time of delivery of the equipment to WMATA. In addition, each library workstation shall include two (minimum) 300GB Hard Drives in place of the above-specified hard drive, a high-speed multi-disc with the capacity to hold all NEPP System documentation discs simultaneously with at least one disk slot remaining available. The library workstations shall be delivered with a state-of-the-art remote data back-up system. Additionally a medium speed (8-10 page per minute), 600 dots per inch resolution laser printer shall be included for making hard copies of desired output. Microsoft Office® release shall be installed on each PC with the version approved by WMATA.

Each library workstation shall include a DVD writer drive with pre-mastering/mastering software. As a minimum, the drives shall be the equivalent of the year 2011 models capable of reading at 32X, writing at 8X and re-writing at 4X. It shall be capable of multi-session recording, on–the–fly recording, incremental packet writing, and disc–at-once/track–at-once recording. A minimum of 500 recordable DVD discs shall be supplied with each drive.

20.7 Required CDRLs

The following CDRL items are referenced in this Section.

CDRL No.	Description	Section	Due	Approval Required
20-1	Electronic versions of all final drawings	20.1	Each Installation Phase	Yes
20-2	List of sensitive information to be included in manuals	20.2	FDR	Yes
20-3	Manual Outlines	20.3.1	CDR	Yes
20-4	Preliminary Draft Manuals	20.3.2	PDR	Yes
20-5	Final Manuals	20.3.3	45 Days Prior to Deployment	Yes
20-6	Final NEPP System Manuals	20.3.4	FAT for final deployment	Yes
20-7	Manual Revisions	20.3.5	As needed, through warranty period	Yes
20-8	Complete Bill of Material (BOM) for each piece of equipment	20.4.2.6	15 days prior to installation	No
20-9	Security Manual	20.4.4	FAT for final deployment	Yes
20-10	Recommended Consumable Parts List	20.5.1.2	FDR	No
20-11	Recommended Replacement Parts List	20.5.1.3	FDR	No
20-12	Recommended Repair Parts List	20.5.1.4	FDR	No
20-13	Recommended Overhaul Parts List	20.5.1.5	FDR	No
20-14	Spare Parts Inventory	20.5.1.6	30 days prior to installation	Yes
20-15	List of Component Sourcing	20.5.2	15 days prior to installation	No
20-16	Custom Tools List	20.5.3	CDR, FDR	No
20-17	MSD Hardware elements details	20.5.5.1	CDR, FDR	Yes
20-18	MSD Displayed Messages List	20.5.5.1.1.	CDR, FDR	Yes
20-19	MSD Software elements details	20.5.5.2	CDR, FDR	Yes
20-20	Simulator Lab Equipment	20.5.6	CDR, FDR	Yes

End of Section 20

Section 21 – Training
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21 TRAINING

The Contractor shall provide a comprehensive program to educate and train WMATA-designated personnel to operate, service, support, and maintain the New Electronic Payments Program (NEPP) and equipment satisfactorily.

WMATA-designated personnel shall include WMATA employees as well as employees for contracted services and other individuals or entities as defined by WMATA. This training program shall incorporate two training methodologies:

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

B. Training sessions provided by the NEPP Contractor directly to WMATA-designated personnel.

Training shall be provided as identified in Table 21-1.

Provision of training and delivery of training materials shall follow the deployment phases as identified in Section 19. For each of these phases, draft and final training documentation shall be provided to reflect the changes incorporated into each deployment phase.

Training for each phase shall include only those NEPP System elements which are included in that deployment phase unless approved otherwise by WMATA prior to the commencement of any training. In addition, for all phases after the first phase, the Contractor shall include refresher training for those functions and features identified by WMATA not less than sixty (60) days prior to the commencement of the training for that phase.

Where training documentation is not affected by phased deployment of equipment and/or functionality, the training documentation shall not require any revision by the Contractor.

21.1 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, 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 NEPP Contractor to bring WMATA-designated personnel to the level of proficiency required for performing their respective duties.

The training sessions shall be aimed at providing an employee with the basic knowledge, skills and abilities to perform their respective duties, the information needed to successfully perform their job on or with the NEPP supplied equipment, and shall allow future training courses to benefit fully from the NEPP System training materials provided.

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 NEPP System equipment 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. Practical “hands-on” training using the actual equipment, systems, and software shall occupy a significant portion of all training classes 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 the NEPP System. Hands-on training shall also be utilized as a minimum for NEPP applications, including file generation and revision, uploads and downloads.

The Contractor shall provide all training aids and visual aids to conduct all training sessions. At least one session of each different training course shall be video and audio recorded by the Contractor and provided on standard DVDs as a deliverable at the completion of each deployment phase as part of the system acceptance for that phase. **CDRL 21-1**

Since the NEPP System shall be deployed in several phases, to suit the functional requirements of WMATA, operational training shall be provided at each deployment phase to ensure that new functionalities are accommodated into WMATA business processes. All training materials, documents and recordings shall become the property of WMATA at the conclusion of the training for each deployment phase.

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; revenue collection and reporting emphasis for revenue personnel and management; general overview for executive management.

21.2 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.

The Contractor shall submit qualifications for the proposed instructors, including experience in providing similar training to other clients, for WMATA review at Preliminary Design Review and for approval at Final Design Review. **CDRL 21-2** Even after an instructor is approved, WMATA shall have the right to direct that an instructor be replaced, without adverse impact to deployment schedule or total NEPP System cost.

Once an instructor is identified as providing training for the NEPP System, no change shall be permitted unless authorized in writing by WMATA a minimum of 30 days prior to the commencement of the affected training.

21.3 Training Schedule

All training shall be scheduled in coordination with and for approval of WMATA. **CDRL 21-3** The schedule shall be consistent with the following factors:

A. Production equipment and system software are available to support “hands-on’ classroom training;

B. Completion of training will occur in time for WMATA-designated personnel to perform their duties related to the new NEPP System prior to system deployment;

C. Lag time between training completion and actual use of skills shall be minimal;

D. Availability of existing personnel may be affected by current responsibilities and may limit number of personnel available by time of day;

E. At the discretion of WMATA, maintenance training shall occur prior to any field equipment installation, with scheduled field time provided for the technicians to observe and monitor equipment installation and acceptance testing rather than as identified in Sections 21.6.5 and 21.6.6;

F. Proficiency testing shall be scheduled prior to system deployment.

As directed by WMATA, the Contractor shall, during each deployment phase and through the warranty period, provide at least five additional refresher-training sessions for all courses at no additional cost to WMATA. These refresher-training sessions shall be held in the Washington D.C. area at WMATA designated locations and shall accommodate the same number of individuals as the initial training session.

21.4 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 21-4** The training program plan shall include the following information, as a minimum:

21.4.1 Program Description

A narrative description of the overall approach to the training program shall be provided, 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.

21.4.2 Training Schedule

A schedule shall be included in the training program plan for each deployment phase. 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 Table 21-1.

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;

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.

21.4.3 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);

F. Resources required from WMATA, including classroom, field and shop space; vehicles, facilities and other necessary items;

G. Approximate time, in days and hours per day, required for classroom and field training for each course.

21.4.4 Contractor's Training Experience

All of the instructors provided by the Contractor shall be fully capable of transmitting in-depth technical information that can be understood by WMATA participants. A detailed resume for each instructor shall be provided to WMATA for approval, 60 days prior to commencement of scheduled course instruction. **CDRL 21-5** WMATA will recognize the instructor as qualified when the individual:

A. Can communicate, in English, in a manner that allows the participants to fully understand the information being articulated;

B. Has been trained in adult teaching principles and methods and has had experience in conducting technical training courses, or can demonstrate sufficient technical training experience such that WMATA designates the candidate as qualified;

C. Has an in-depth knowledge of the NEPP system element under discussion, how it interfaces with other systems or subsystems, the logic and methodology for isolating faults and troubleshooting, and is able to communicate that information to students in an effective manner;

D. Is able to design practical and written tests to determine that the course's learning objectives, as stated in the curriculum, can be successfully accomplished by the students; and

E. Has an in-depth knowledge of WMATA Policies and Procedures concerning safety and operations.

21.5 Training Course Curricula and Materials

The Contractor shall submit course curricula and training materials for the initial deployment phase as a part of the Preliminary Design Review and as a part of the Final Design Review for approval by WMATA. **CDRL 21-6**

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 60 days prior to commencement of any training class for the NEPP System.

For subsequent deployment phases course curricula and training materials shall be provided as part of the updated training program plan as identified in Section 21.4.

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.

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.

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

Power Point presentations for use with laptop computer and data projector 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 NEPP 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. **Training Support Equipment**: Where an actual set of NEPP equipment or special tool/test equipment is planned for use as a training aid, an additional set, specifically for the purpose of training, shall be added to the number required for delivery. Contract spares will not be used for training. In addition, four laptops plus video/data projection equipment shall be provided for the train the trainer program and shall become the property of WMATA at completion of the training program. **CDRL 21-7**

F. **Location:** Unless otherwise indicated, all training sessions shall be provided at WMATA-provided locations in or near the WMATA operations area. In the event that the Contractor proposes that training occur in a location, which is not in or near the WMATA operations area, costs for WMATA staff travel and subsistence shall be borne by the Contractor. Note that WMATA will not permit the NEPP Simulator Lab to be used for NEPP Contractor training purposes.

G. **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. All training submissions and schedules shall be subject to approval of WMATA.

At the completion of all training courses, one set of camera-ready, letter quality originals suitable for reproduction for all training materials shall be delivered to WMATA in addition to the final electronic versions of the training materials. **CDRL 21-8** WMATA reserves the right to reproduce these materials for its use.

21.6 Training Courses

The Contractors shall provide the courses identified in Table 21-1. For each class trained by the Contractor, the Contractor shall provide hard-copy sets of student training materials for each identified class in quantities equal to the number of trainees identified in the table, plus an additional five copies. **CDRL 21-9** 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 21-10** Five hardcopy sets of instructor's materials for each class shall also be provided to WMATA. **CDRL 21-11**

Table 21-1 - Required Training

Training Class	Trainees	Train the Trainer	Section	No. of Trainees	Hours Per Class (per Device)	Quantity of Devices	Hours per Class	Estimated Attendees per Class	Class Sessions	Required Refresher Courses	Total Classes Required	Initial Student Training Materials
NEPP System Overview	WMATA Management and executive staff, third party sales agents	Yes	21.6.1	TBD	4	1	4	5	1	3	TBD	TBD
Surface Fleet Operations and Customer Assistance	Surface Fleet Operators, Supervisors	Yes	21.6.2	TBD	2	1	2	5	1	3	TBD	TBD
Rail Operations and Customer Assistance	Station Agents, Sales Agents (including third party), WMATA Management	Yes	21.6.3	TBD	4	4	16	5	1	3	TBD	TBD
Parking Operations and Customer Assistance	Parking Operations and Management Staff	Yes	21.6.4	TBD	4	5	20	5	1	3	TBD	TBD
Field Maintenance	Maintenance Staff, WMATA Management	No	21.6.5	TBD	40	8	320	10	5	3	TBD	TBD
Shop Maintenance	Maintenance Staff, WMATA Management	No	21.6.6	TBD	40	8	320	10	5	3	TBD	TBD
Revenue Servicing of NEPP Devices	Revenue, Internal Audit, Revenue Mgt.	Yes	21.6.7	TBD	4	4	16	5	1	3	TBD	TBD
Cash Room Operations	Revenue, Finance, Int. Audit	Yes	21.6.8	TBD	4	1	4	10	1	3	TBD	TBD

Training Class	Trainees	Train the Trainer	Section	No. of Trainees	Hours Per Class (per Device)	Quantity of Devices	Hours per Class	Estimated Attendees per Class	Class Sessions	Required Refresher Courses	Total Classes Required	Initial Student Training Materials
Revenue Reconciliation & Reporting	Revenue, Finance, Int. Audit, IT	Yes	21.6.9	TBD	8	2	16	corrections10	1	3	TBD	TBD
CDS Systems Management Course	IT Systems, Int. Audit, WMATA Management,	No	21.6.10	TBD	64	1	64	5	5	3	TBD	TBD
Network Administration Course	IT Systems, Int. Audit, WMATA Management,	No	21.6.11	TBD	80	1	80	5	5	3	TBD	TBD
System Administration Course	IT Systems, Int. Audit, Controller, WMATA Management,	No	21.6.12	TBD	64	1	64	5	5	3	TBD	TBD
Account and Fare Media Management	WMATA Operations, CCT Operations, Human Resources, Revenue, Accounting, Customer Service, IT	No	21.6.13	TBD	64	1	64	5	5	3	TBD	TBD

21.6.1 NEPP System Overview

Contractor shall provide an introductory training course to management and supervisory personnel on the NEPP System as well as all devices deployed within the system. Focus of the course shall include all elements of NEPP Equipment operation and shall be based on the NEPP System Overview Manual defined in Section 20. Contractor shall assume that all trainees have a management level of education and experience.

21.6.2 Surface Operations and Customer Assistance

The Contractor shall provide a training course to WMATA personnel for the operation of Surface NEPP equipment and assistance of customers with Surface equipment-related problems. Training shall focus on understanding the operation of the equipment to provide customer assistance with problem resolution.

The training shall take place using actual NEPP equipment. At least two units of each type of NEPP equipment shall be supplied for the training and this equipment shall be provided for the entire period of the training.

21.6.3 Rail Operations and Customer Assistance

The Contractor shall provide a training course to WMATA personnel for the operation of Subway/Elevated NEPP equipment and assistance of customers with Subway/Elevated equipment-related problems. Training shall focus on understanding the operation of the equipment to provide customer assistance with problem resolution.

The training shall take place using actual NEPP equipment. At least two units of each type of NEPP equipment shall be supplied for the training and this equipment shall be provided for the entire period of the training.

21.6.4 Parking Operations and Customer Assistance

The Contractor shall provide a training course to WMATA personnel for the operation of Parking NEPP equipment and assistance of customers with Parking equipment-related problems. Training shall focus on understanding the operation of the equipment to provide customer assistance with problem resolution.

The training shall take place using actual NEPP equipment. At least two units of each type of NEPP equipment shall be supplied for the training and this equipment shall be provided for the entire period of the training.

21.6.5 Field Maintenance for NEPP Devices

The Contractor shall provide a training course to WMATA personnel for performance of all maintenance on NEPP devices in a field environment. The training program shall be centered on the field maintenance manual developed under the requirements of Section 20. This training shall cover:

A. power, wiring and connections, software, and communications;

B. preventive maintenance of the NEPP equipment;

C. fingertip and first line maintenance;

D. equipment diagnostics and troubleshooting;

E. corrective maintenance; and

F. LLRU change-out.

The training shall take place using actual NEPP equipment. At least two units of each type of NEPP equipment shall be supplied for the training and this equipment shall be provided for the entire period of the training.

Field maintenance training, approximately 40 hours per equipment type, shall commence not more than four months prior to the expiration of the warranty or any Contractor provided maintenance period, whichever is later.

21.6.6 Shop Maintenance for NEPP Devices

The Contractor shall provide a training course to WMATA personnel for performance of maintenance on NEPP devices in a WMATA back-shop environment. The training program shall be centered on the shop maintenance manual developed under the requirements of Section 20 so that for each LLRU WMATA maintenance personnel will be able to effectively service, inspect, maintain, adjust, troubleshoot to component, remove, and replace faulty components. This training shall cover:

A. Preventive maintenance;

B. Back-shop repair and fault diagnosis to the component level for all LLRU's; and

C. Module overhaul.

The training shall take place using actual NEPP equipment. At least two units of each type of NEPP equipment shall be supplied for the training and this equipment shall be provided for the entire period of the training.

The shop maintenance repair-training course shall instruct personnel in the proper use of using the Test Equipment to diagnose and repair component level LLRU fault conditions.

Shop maintenance training, approximately 40 hours per equipment type, shall commence not more than four months prior to the expiration of the warranty or any Contractor provided maintenance period, whichever is later.

21.6.7 Revenue Servicing

The Contractor shall provide training classes for the complete revenue service operation at stations and at other locations where revenues are collected using the NEPP equipment. For the station and other "fixed location" equipment, this training shall cover all aspects of the media stock replacement, revenue container exchange, and of cash room processing.

The training program shall be centered on the Revenue Service manual developed under the requirements of Section 20.

21.6.8 Cash Room Operations

The Contractor shall provide training classes on the safe and proper operations of all new Cash Room equipment provided under the Contract.

The training program shall be centered on the Cash Room operations manual developed under the requirements of Section 20, and shall be performed in WMATA's Cash Room using the actual delivered equipment.

21.6.9 Revenue Reconciliation and Reporting

In addition to the standard revenue service training, a separate training session shall be provided by the Contractor to selected WMATA personnel for reconciliation of the revenues collected by the NEPP sales devices, the Internet services and all credit card/debit card accepting devices.

The training program shall be centered on the Revenue Reconciliation manual developed under the requirements of Section 20

This shall cover all aspects of the cash reconciliation and the settlement process, including generation and interpretation of all related reports. Training materials shall be identified as "CONFIDENTIAL" and shall be sequentially numbered. A minimum of eight hours of training shall be taught to Revenue Department supervisory personnel.

21.6.10 CDS Systems Management

The Contractor shall provide an experienced and qualified instructor who shall conduct training classes for the operation of all CDS components. The purpose of the training classes is to familiarize and train WMATA personnel who will be operating the CDS.

Training shall be provided to fully familiarize IT, operations, planning, finance and other WMATA-designated personnel with all aspects of the system software including the structure of the applications, tables utilized, network connections and settings, wireless communications protocols, as well as other similar information.

The training plan and training documentation shall be approved prior to the training. The trainer for this course shall be well versed in Microsoft® SQL Server 2008 software as well as all other third-party software systems and application software, since information shall be highly technical and more than just end-user type training. The trainees shall receive a minimum of sixty-four (64) hours of instruction by the Contractor to provide the necessary training for complete understanding and proficiency for the CDS operation.

At the conclusion of training, the involved WMATA personnel, including the Database Administrators and Programmer Analysts shall have thorough understanding of:

A. NEPP System limitations;

B. Applications' architectures;

C. Data flows;

D. Internal and external interfaces;

E. Communications protocols (wired and wireless);

F. Development tools used;

G. Directory structures;

H. Processing scripts;

I. Data dictionaries;

J. System flows;

K. Table structures and relationships;

L. Table growth;

M. Data conversion methods;

N. Recommended backup strategies;

O. Application programs.

Data diagrams shall be developed and provided to WMATA as a part of the training materials. All programs shall be defined and described fully showing all inputs/outputs, samples of reports, logic flows and major functions described, as well as assumptions used during program development. Detailed system functional requirements shall also be provided.

21.6.11 Network Administration

The Contractor shall provide a course to familiarize personnel with the operation and management of the NEPP Networks. The course shall be comprehensive and cover all functions related to the NEPP Networks.

The course shall be designed so that, upon completion, a technician with a basic education in electronic fundamentals will be qualified to perform all levels of installation/setup, maintenance, and trouble-shooting of the equipment down to the component level for NEPP Network and associated components.

This course, shall at a minimum, include the theory of operation and practical maintenance procedures for the NEPP Networks. The course shall be conducted in phases or levels and shall be designed to move from more general to specific information as the course progresses, with sensitive information to be discussed as the last element of the course.

The Contractor shall provide a minimum of 80 hours of basic training. Additional training shall be provided for the security-sensitive information to be provided to authorize users only and this training shall be in addition to the basic training.

21.6.12 System Administration

The Contractor shall provide training to familiarize personnel with CDS operation and management. Training shall cover all CDS functions including but not limited to:

A. Field device components and sub-systems monitoring and condition and status querying;

B. Device software configuration and downloading;

C. Remote control of device functions and operations;

D. Preparation and generation of Systems Reports;

E. All system programs, their operations, and execution;

F. Interpretation and understanding of all status messages, alarms, events, and indicators;

G. System and equipment restarting and rebooting;

H. Fare Media Management;

I. Data analysis and understanding;

J. Control of passwords for authorized personnel;

K. Security features and operations for authorized personnel;

L. Troubleshooting procedures and status monitoring.

The course shall be conducted in phases or levels and shall be designed to move from more general to specific information as the course progresses, with sensitive information to be discussed as the last element of the course.

All commercial programs used as part of the Data System shall have self-directed tutorial routines, where available, and on-line help routines as part of their software and documentation. All user programs delivered with the System shall include on-line, context sensitive help routines as part of their software.

The Contractor shall provide a minimum of 64 hours of basic training. Additional training shall be provided for the security-sensitive information to be provided to authorize users only and this training shall be in addition to the basic training.

21.6.13 Account and Fare Media Management

The Contractor shall provide a course to familiarize personnel with methodology and systems by which WMATA shall manage of all types of fare media as well as WMATA's accounts associated with the Fare Media. In addition, the training course shall incorporate instructions on how to assist Customers utilizing the Customer Support Center functionalities provided in Section 22 of the Contract.

The trainees shall receive a minimum of 64 hours of instruction by the Contractor to provide the necessary training for complete understanding and proficiency in providing customer support to the external users of the NEPP System.

21.7 Testing and Verification

The Contractor shall provide at least three post-training tests for each type of training course. These tests shall provide not less than 50 questions for each completed training class. Instruction shall be concluded when each participant achieves a score of 90% or higher on the tests. Re-tests, as needed, shall be conducted using a different post-test than the initial test used. Each version of the test shall be provided to WMATA as a part of the Training Program Plan for their review and for verification that the testing appropriately reflects, the material provided as part of the training. **CDRL 21-12**

21.8 Required CDRLs

The following CDRL items are referenced in this Section.

CDRL No.	Description	Section	Due	Approval Required
21-1	Video and audio recording of each training course	21.1	Completion of each deployment phase	No
21-2	Instructor Qualifications	21.2	PDR, FDR	Yes
21-3	Training Schedule	21.3	45 days after NTP	Yes
21-4	Training Program Plan	21.4	PDR, 90 days prior to deployment	Yes
21-5	Instructor Resumes	21.4.4	60 days prior to course	Yes
21-6	Course Curricula and Training Materials	21.5	PDR, FDR	Yes
21-7	Train the Trainer Laptops and Equipment	21.5	Prior to Train the Trainer Program	No
21-8	Training Materials	21.5	Completion of course	No
21-9	Student Training Materials – Hard Copy	21.6	Prior to course	No
21-10	Student Training Materials – Electronic Copies	21.6	Prior to course	No
21-11	Instructor Materials	21.6	Prior to course	No
21-12	Training Course Tests	21.7	Prior to course	Yes

End of Section 21

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22 CUSTOMER SUPPORT SERVICES

The Contractor shall provide all professional services and staff necessary to operate WMATA's New Electronic Payments Program (NEPP) Customer Support System (CSS) for the duration of time identified in the Contract.

WMATA plans to roll out the NEPP in phases as described in Section 19. The remote NEPP Customer Support Center shall begin operations concurrent with the NEPP Customer Service Application (CSA) website-based services. Dependent upon the system design selected by WMATA pursuant to issuance of a Contract, the Customer Support System shall be prepared to support the NEPP System with funds stored and managed from individual accounts associated with WMATA and Partner-issued smart media. The NEPP Customer Support System shall provide customers with the ability to view transactions, purchase fare products, and direct funds for auto-replenish or periodic loading of accounts. The Customer Support System and all Customer service procedures performed within the scope of this Section shall comply with PCI-DSS guidelines.

WMATA requires the ability to transition the responsibilities for these services to WMATA or to another WMATA-approved entity at the conclusion of the performance period of the Customer Support Services Contract. Accordingly, at the conclusion of the Customer Support Services performance period, the Contractor shall, at no charge, turn-over to WMATA all items used by the Contractor to perform the Customer Support Services defined in this Section, including but not limited to, manuals, procedures, computers, applications, devices, tools and vehicles. **CDRL 22-1**

Furthermore, the Contractor shall ensure that the design of the NEPP systems used to facilitate the Customer Support Services shall have a clearly defined interface and are able to accommodate transition to WMATA or a WMATA-designated entity without the need for additional hardware or software changes. WMATA requires the ability for these systems to interface with and accommodate new elements and functionalities from a WMATA-designated entity.

Contractor shall provide a full description of the architecture to be deployed for the NEPP Customer Support System to meet all of WMATA's requirements not more than 90 days after NTP. **CDRL 22-2**

The NEPP Customer Support Center shall operate independently of WMATA's customer service center. However, both centers may require access to certain NEPP information at the same time. All training will be the responsibility of the Contractor.

The customer care operations will utilize the defined Customer Services Application (CSA) functionality with a minimal number of additional screens to support the NEPP Customer Support Center. WMATA requires that the NEPP Customer Support Center utilize Interactive Voice Response (IVR) technology, designed or leased, to minimize the number of calls handled by live operators.

The NEPP Customer Support functions shall focus on responding to issues specific to operation of the NEPP. Calls or other queries received by the Customer Support Center related to WMATA specific issues such as timetable or other such non-NEPP inquiries, shall be routed to the appropriate WMATA department for handling.

The NEPP shall provide the following services as outlined in this Section:

- Media Base Management:
    - Customer Inquiries, Complaints and Discrepancies;
    - Balance Protection;
    - Transit Benefits Program;
    - Invalid Smart Media List;
    - Bad Number List;
    - Auto-replenishment;
    - Photo ID Media Management;
    - Reduced Fare Program;
    - MetroAccess Program.
- Customer Support:
    - Application Processing;
    - Mail Processing;
    - Internet-based Service;

- Telephone-based Service;
- Employer Subsidized Smart Media Account Sales Processing;
- Remote Receipts;
- Preferred Vendor Smart Media Account Sales and Processing.

- Media Distribution Management:
  - Returns and Replacement;
  - Mail Distribution;
  - Internet Distribution.

- Financial Management:
  - Service Center Reconciliation;
  - Revenue Handling Requirements;
  - Revenue Handling for Check Customers;
  - Revenue Handling for Credit Media and Debit Customers.

- Performance Monitoring:
  - Monitoring and reporting on Key Performance characteristics as required in the Technical Specification.

These services shall be provided by phone, by US mail, by e-mail, and through the Contractor-developed and hosted CSA.

22.1 Media Base Management

22.1.1 Customer Inquiries, Complaints and Discrepancies

The NEPP shall provide efficient handling, investigation, and resolution of customer requests for support with NEPP Smart Media and devices, customer inquiries, complaints, discrepancies, and potential fare disputes. Fare disputes shall be governed by the fare structure and fare policy of WMATA.

To resolve fare disputes, the NEPP Customer Support Representatives (CSRs) shall be familiar with WMATA's fare structure and fare policy, and shall have electronic copies of reference materials at their individual workstations for fast and easy lookups.

The Customer Support System shall create a record of each customer inquiry, complaint, discrepancy, and potential fare dispute. Each record shall include all details necessary to describe the transaction. All records created on a daily basis shall be transferred to the CDS.

22.1.2 Balance Protection

All registered customers shall receive the protection of any unused stored value, stored rides or passes in their WMATA and/or partner issued smart media account. In the event of lost or stolen media, customers shall be required to access the CSA to freeze smart media, halt any fraudulent account activity, "de-link" existing compromised smart media, and link new smart media to the account.

The unused balance as confirmed by WMATA's NEPP database and WMATA issued smart media shall be replaced within 24 hours of the Smart Media being reported lost or stolen. Customers shall be required to provide, and the CSS shall confirm, the Customer Log-on ID and Password for the registered Smart Media before issuing replacements.

22.1.3 Transit Benefits Program

Transit Benefits are Federal Government-supported, employer-sponsored tax benefit programs through which employers can provide employees up to the IRS federally-defined maximum per employee per month in tax-free benefits to be used for public transportation privileges and public transportation parking privileges.

At a minimum, the NEPP shall:

A. Distribute initialized registered smart media to employers or individual customers with segregated funds, in the account, for transportation and parking privileges;

B. Be responsible for set-up, processing and auditing required to perform and modify auto-replenishments to employee smart media accounts;

C. Manage the auto-replenishment process for all scheduled benefit autoloads so that participating employees automatically receive new value or pass loads in their account at the agreed-upon frequency;

D. Receive and distribute uploads of stored value or pass products to enable customers to immediately access benefits backed by agreement of issuing program partner;

E. Provide CSA and telephone customer care support to employers;

F. Return unused funds to employers;

G. Resolve employer auto-replenish discrepancies;

H. Reconcile and audit all employer managed account activity;

I. Manage the monthly reconciliation of scheduled auto-replenishments with the Employer Funds Transfer process;

J. Comply with IRS Revenue Ruling 2006-57.

The customer and employer interface to the Transit Benefit Program shall be through the NEPP website.

22.1.4 Auto-replenishment

Within the NEPP, auto-replenishment services shall permit registered users to automatically load value to their account on an “as needed” basis. The Contractor shall review and approve or deny user applications for auto-replenishment services in accordance with WMATA’s business rules. The system shall enable auto-replenishment on smart media accounts in a remote manner (that is, not require the customer to present the Smart Media in person or by mail).

The NEPP shall administer a “Post-bill” model. When the smart media account reaches a system threshold, the NEPP shall load the Transit Account with a Customer-designated amount. The participants’ Credit or Debit account shall be billed for the value loaded into the smart media Transit Account. If funds are not successfully collected, the account will be negatively loaded for the value of the transaction. The customer shall be notified of the problem for resolution using the communications methodology selected by the customer when first registering for the account and associated smart media. Methodologies shall include phone, SMS text, e-mail or US Mail.

Auto-replenishment services shall occur through the web-based CSA outlined in Section 5.

Customers shall be required to register or sign up their account for auto-replenishment service. The NEPP shall support such sign up by telephone, fax, mail, e-mail, and over the internet via the CSA. At the time of sign-up, the account owner may be required to specify, at a minimum, the funding amount, and appropriate account to be used to pay for the value being loaded onto the account.

Customer applications received by fax or mail at the NEPP Customer Support Center shall be approved or denied and loaded into the CDS system within two working days of receipt of the application. Applications received by telephone or through the NEPP CSA shall be approved or denied immediately. The only acceptable forms of payment for a Threshold Autoload (for example, reloading a fixed amount when the account reaches a predetermined amount or reloading a calendar pass when the previous calendar pass expires) are Credit Cards, Debit checking accounts, and other acceptable external accounts such as a PayPal and similar external accounts as defined in Section 4. Checks, money orders, and electronic transit benefits may only be used for non-recurring replenishments.

The Contractor shall provide a complete description of the Auto Replenishment function for WMATA review at the Preliminary Design Review and for WMATA approval at the Final Design Review. **CDRL 22-3**

22.1.5 Photo-ID Media Management

Customized smart media shall be issued by the Contractor upon request with the employee's or participants' picture on the face of the NEPP Media. Special requests for customized media will be billed to the requestor and not the Contractor. Contractor shall use the Media Photo ID software that interfaces with both the NEPP Media printer and the camera.

22.1.6 Reduced Fare Program

The WMATA Reduced Fare Program (RFP) allows Senior Citizens and Disabled individuals to access WMATA transportation service at free or reduced fares. The NEPP shall process the applications and record customer data for the RFP. The Contractor shall produce and distribute personalized smart media to eligible Senior Citizens and Disabled persons, including the capture and maintenance of the digital photographs for the RFP smart media.

22.1.7 MetroAccess Program

The WMATA MetroAccess Program allows individuals to access WMATA paratransit service. The NEPP shall be capable of processing customer applications, and recording customer data and eligibility for all elements of the MetroAccess Program. The Contractor shall produce and distribute personalized smart media to eligible persons, including the capture and maintenance of the digital photographs for the MetroAccess smart media. Based on WMATA policies, MetroAccess smart media shall also be capable of allowing eligible MetroAccess customers to access the WMATA fixed route system in addition to Paratransit service. The NEPP smart media shall also allow an eligible MetroAccess customer's personal care assistant (PCA) access to fixed route system.

The NEPP shall also allow for a seamless transition for customers having an existing EZ-Pay account to a NEPP account.

22.1.8 Media Base Management Reporting

The Contractor shall provide standard and ad-hoc reports from the CDS for WMATA to monitor the Media Base Management detailed within Section 22.1, Media Base Management. These reports shall provide WMATA with the daily, weekly, and monthly statistics on the Contractor's performance in all defined Media Base Management functions. General requirements for the reports shall be as defined in Section 22.6. At a minimum, Media Base Management reporting shall include, but not be limited to:

- Fare media sales and distribution totals;
- Fare media registered to and de-linked from Transit Accounts;
- CSS changes is the Invalid Media lists, Positive Number lists, etc.

22.2 Customer Support

All Customer Support Application (CSA) software shall be designed to be user-friendly and provide quick response to user selections. The Customer Service screens and applications shall follow standard web page design practices and utilize "radio buttons," check boxes, pull-down menus, fill-in-the-blank spaces, and other common features to simplify response to customer queries and to assist when in-person smart media accounts are established.

22.2.1 Application Processing

To issue a customer an item of WMATA smart media, an account shall be established in the CDS. All accounts shall be anonymous and shall accommodate a single item of smart media unless a Customer Profile has been created for the customer and the customer registers their smart media. Set up of a Customer Profile shall include all information necessary to uniquely identify the customer. At a minimum, the data records for each customer shall include the *Customer Records* attributes identified in Section 5.

After a Customer Profile is set up and the customer is registered, the customer shall be able to assign multiple smart media to that Customer Profile. This shall permit all of the smart media to be more easily managed, including setup and maintenance of replenishment criteria and associated payment accounts. It shall be possible to associate all replenishment actions with a single payment method, and to provide different methods of replenishment for each smart media within the Customer Profile.

Contractor shall utilize a standard Customer application form to establish new Customer Profiles and register smart media, assign existing and new smart media to an existing Customer Profile, and issue new WMATA smart media and setting up an account. Once assigned to a Customer Profile, the NEPP shall not be able to assign the same Smart Media to another Customer Profile.

Contractor shall process, approve, and keep on file applications of each Customer Profile and account requested. The NEPP shall record each established Customer Profile and account with associated smart media.

Applications shall be able to be provided by mail, telephone and through the NEPP CSA, and then shall be processed. The Contractor shall convert written applications to a digital format as part of processing the application. Customers shall be provided with a copy of their completed Customer Profile information via mail, e-mail, or other confirmation mechanism as approved by WMATA and as selected by the customer.

Smart media shall be provided to the customer before smart media activation can be completed. Once received, the customer shall then activate the smart media using either the NEPP Customer Support Call Center or the NEPP CSA.

The Contractor shall provide a complete description of the Application Processing function for WMATA review at the Preliminary Design Review and for WMATA approval at the Final Design Review. **CDRL 22-4**

22.2.2 Mail Processing

Contractor shall establish procedures to ensure the proper control and handling of incoming and outgoing mail. The procedures shall cover handling mail that includes applications and payments, as well as mail concerning complaints, inquiries, or comments. Contractor shall develop responses in accordance with WMATA guidelines.

Contractor shall estimate the daily quantities of mail based upon WMATA's ridership statistics as well as the Contractor's experience in performing such activities.

22.2.3 Internet-Based Service

The Contractor shall develop and host a secure web-based CSA to serve as the E-Commerce web site for the NEPP. The CSA shall share a common design theme with WMATA's existing web pages and shall be accessed by the Customer via WMATA's existing Metro website.

The CSA shall provide sales and support services for all NEPP functionality, including customer account management. The CSA shall be designed in accordance with all requirements listed in Section 5. In addition, the CSA shall provide the following web page user interfaces and functionality.

The Contractor-designed NEPP CSA web pages shall follow standard web page design practices and utilize "radio buttons," check boxes, pull-down menus, fill-in-the-blank spaces, and other common features to simplify product selection and purchases. The web pages shall include a "shopping cart" feature that allows users to add, delete, modify selections, and when ready, conduct a single transaction to complete the purchase.

All CSA web pages shall be usable by patrons who are visually impaired. In addition, all CSA web pages shall be usable on a variety of devices, including popular mobile devices such as smart phones and tablet computers.

Each distinct web page type identified below shall be consistent within that type. (For example, if multiple Product Selection pages are required, all will share a common appearance and format.) Each distinct web page type shall be designed and optimized according to the purposes of the page.

Where user input is required, the Contractor-designed web pages shall support standard browser data entry operations such as the TAB key moving to the next data field, the ENTER key acting as “Submit” or “Go,” etc.

The Contractor shall provide distinct web page types to support NEPP E-Commerce operations, and customer support. At minimum, the Contractor shall develop the following web pages:

- WMATA NEPP CSA Start;
- WMATA Customer Registration for NEPP (New, Login, Modify, and other pages as necessary);
- NEPP Product Selection;
- Shopping Cart Contents;
- Secure Checkout;
- Purchase Confirmation;
- Order Status;
- NEPP Customer Subscription Management (New/Modify Subscribable Product Selection, Repeat/Subscription Payment Authorization, and other pages as necessary);
- Employer Administrative (Secure login and multiple other pages to permit an employer to efficiently manage their Employer Smart Media program);
- Smart Media Order Fulfillment (Login, generate sales order, update order status, query order processing status and other pages as necessary);
- WMATA NEPP Administration (Login and multiple other pages as necessary).

The CSA shall allow a customer to log in to an established WMATA account using an account ID or user selected username and password. The web site shall provide a fully automated system for assisting the customer with creating or changing an optional username, selecting and/or changing a password, or retrieving lost or forgotten log in information.

The NEPP CSA shall accommodate a “single sign-on” account to WMATA websites. The Customer shall be able to log-in to the NEPP CSA and obtain authenticated access to SmarTrip and NEPP fare media services. Once logged in to the NEPP CSA, the Customer shall be able to navigate between NEPP CSA pages and all other WMATA web pages without the need to further authenticate log-in credentials. The Customer shall be required to, at a minimum, re-enter their password if all NEPP CSA and WMATA web pages are exited and subsequently re-entered within a configurable maximum period of time and within the same web browser session.

After a WMATA configurable period of inactivity, all users logged into the CSA shall be automatically logged off, at which time the user’s session shall be directed to the CSA Start page.

The Contractor shall provide a complete description of the design and functionality of all CSA web pages for WMATA review at the Preliminary Design Review and for WMATA approval at the Final Design Review. **CDRL 22-5**

22.2.3.1 WMATA NEPP CSA Start Page

The CSA Start Page shall be the destination for all links to the CSA from other WMATA web pages. The page shall provide general information about the CSA’s features. In addition, the page shall include:

- Fill-in blanks for the user to enter login and password to begin a session and enter the site;
- A “Go” button to submit the entered login and password;
- A link to enter a new user registration;
- A link to the Employer Administrative login page;
- A check box to create a cookie on the user’s device to remember the user’s login and pre-fill that space. (By default, the checkbox shall be unselected.)

Previously registered users who successfully log into the CSA shall be directed to the first Product Selection Page.

Except for the CSA Start page, all web pages for general customer use shall include a common set of buttons or tabs to facilitate navigation on the CSA. These common buttons or tabs shall include at minimum:

- WMATA Home – when pressed, this button shall request confirmation, and if confirmed, shall cause the user's CSA session to terminate and return the user to the WMATA Home page;
- Log off – when pressed, this button shall request confirmation, and if confirmed, shall cause the user's CSA session to terminate and return the user to the CSA Start page;
- Registration – when pressed, this button shall navigate to the Customer Registration page;
- Subscriptions – when pressed, this button shall navigate to the Customer Subscription page;
- Shopping Cart – when pressed, this button shall navigate to the Shopping Cart Contents page;
- Check Out – when pressed, this button shall navigate to the Checkout page;
- Continue Shopping – when pressed, this button shall navigate to the first Product Selection page;
- Order Status – when pressed, this button shall navigate to the Order Status page.

All WMATA and Employer Administrative pages shall also include a Log off button or tab, which when pressed shall terminate the user's session.

22.2.3.2 Customer Registration Page

All users shall be required to register with the WMATA NEPP CSA. First-time users shall be directed to this page by selecting the appropriate link on the CSA Start page. Previously registered users shall be able to navigate to this page to review and edit registration information.

Data entry on this page shall be user-friendly and shall include pull-down menus and error checking where appropriate. Data fields to be entered shall include those identified in Section 5. Required fields shall be identified on the screen, and shall be determined during the Preliminary Design Review.

Upon completing the form and pressing a “Submit” button, the user shall be directed to the first Product Selection Page.

22.2.3.3 Product Selection Page

Driven by the Products database table described in Section 5, one or more Product Selection pages shall provide users with an easy-to-use interface to select products and quantities for purchase. Each product type available shall include a check box for selection, and a fill-in box for quantity. Each line on the Product Selection page shall also include the product’s unit price.

When a product’s check box is selected, a value of one shall be automatically entered into the quantity fill-in box. The user shall be able to enter other quantities in the fill-in box, but valid quantities for purchase shall be limited according to the parameter defined in the Products database table.

For each product that can be purchased by the user, the selection shall include a checkbox to permit the user to determine whether to print the item or to have it shipped.

Each Product Selection page shall include one or more highly visible “Check Out” and “View Shopping Cart Contents” buttons to facilitate the purchase process.

In addition, each Product Selection page shall include a highly visible “Customer Subscriptions” button to navigate to the Customer Subscription page.

22.2.3.4 Shopping Cart Contents Page

The Shopping Cart Contents page shall display a summary of the user’s current product selections, quantities, extended prices for each item (unit price times quantity), any additional shipping costs per item, and total purchase value. Where applicable, the Shopping Cart Contents page shall also indicate whether a product is to be printed by the user or shipped.

The Shopping Cart Contents page shall enable users to delete any item, change the purchase quantity, and where applicable, change whether the product is to be printed by the user or shipped.

The Shopping Cart Contents page shall include highly visible “Check Out” and “Continue Shopping” buttons to facilitate navigation and the transaction process.

22.2.3.5 Checkout Page

Upon completion of product selection and pressing a “Check Out” button, the user shall be directed to the Checkout page. This page shall include the user’s registration information (such as name and address) already filled in, and shall provide additional fill-in blanks, drop-down menus, radio buttons, and check boxes as required to complete the transaction. Fields populated from the User Registration page shall not be alterable on this page; any changes to this information shall require the user to navigate to the User Registration page.

The Checkout page shall provide a complete summary of the purchase, including the selected products, quantities, unit prices, extended prices, total product prices, sales taxes, shipping costs (including any per-item additional shipping costs), and total transaction value. Where applicable, the Checkout page shall indicate whether a product is to be printed by the user or shipped.

A default shipping method shall be displayed in a selection pull-down menu, with its associated price filled into the appropriate space on the transaction summary. Users shall be able to select an alternate shipping method; upon doing so, the transaction summary shall update automatically. At a minimum, the Checkout page shall offer shipping method choices of Regular (First Class mail) or Preferred (Express Mail). If the user has opted to print all purchased products, the page shall offer no shipping method choice.

Users shall be required to select a payment method from a selection pull-down menu. Upon doing so, the appropriate fill-in boxes shall appear for the user to complete. If the user is paying by Credit Media, separate billing address fill-in blanks shall be provided, along with a check box to use the user's delivery address as the billing address. If the "use delivery address" check box is selected, the billing address information shall be automatically populated from the user's delivery address data. Credit Media payments shall also require the user to enter the Credit Media ID number (which is usually printed on the back of the Media).

The Checkout page shall offer all acceptable payment methods outlined in Section 4.

The Checkout page shall include highly visible buttons to:

- Submit – completes the transaction;
- Return for More Shopping – saves all information and returns the user to the first Product Selection Screen;
- Change User Information – navigates to the User Registration page. Upon return to the Checkout page, any changes in the user's registration information shall be incorporated in the relevant page fields.

22.2.3.6 Purchase Confirmation Page

Upon successful completion of transaction processing, a Purchase Confirmation page shall appear containing the transaction summary and a transaction number.

If the user has chosen to print any purchased items, a highly visible "Print Purchased Smart Media" button shall appear on the screen. When pressed, this button shall direct the user to the At-Home Smart Media Printing page.

22.2.3.7 Order Status Page

The Order Status page shall allow users to view the status of recent orders. For each of the user's previous orders during a WMATA adjustable time interval, the page shall list:

- The transaction number;
- The date the order was placed;

- The value of the order;
- The current status of the order;
- The date of the current status;
- The shipping method (if applicable);
- The shipping tracking number (if applicable).

The transaction number and the shipping tracking number shall be hypertext link fields. When the user clicks on the transaction number, the Purchase Confirmation page for the transaction shall be displayed. When the user clicks on a hypertext shipping tracking number, the user shall be redirected to the shipping company's web site for package tracking, with all appropriate fields pre-populated.

22.2.3.8 Customer Subscription Pages

When a user selects the "Customer Subscription" button, the system shall present a series of pages that shall enable the user to:

- View all subscriptions in effect;
- Add, delete, and modify subscriptions, including product types, quantities, frequency, subscription expiration date, payment method, shipping method, etc.;
- Review the status of a subscription order.

The Customer Subscription web pages shall appear and function similarly to the one-time transaction pages described above (Product Selection, Shopping Cart, Checkout, Purchase Confirmation, and Order Status), but be optimized for the subscription process. For example, the selection of products shall appear similar to the Product Selection page, except that only products that are eligible for subscription shall be shown (based on the contents of the Products database table as described in Section 5), and the option for user-printed Smart Media shall not be available. (All subscribed transactions shall be shipped to the customer.)

If the user has any products in the Shopping Cart, the Customer Subscription page shall display an error message that informs the user that creating or modifying a subscription requires an empty shopping cart.

After adding a new subscription, or changing or deleting an existing subscription, the checkout process shall result only in the recording of the user's payment information. The Subscription Confirmation page (similar to the Purchase Confirmation page) shall provide the Subscription Transaction Identification number in lieu of a transaction identification number.

22.2.3.9 Status Reporting

Customers shall be able to select reporting of current validity as well as reporting usage.

When selecting "validity" reporting the customer shall select this function from the available selections. The web site shall return the validity of the smart media, based on the last transaction found in the CDS. The information provided shall also include the date, time and equipment location/route/station of last use. The customer shall be able to print this validity information.

After selecting "usage reporting", the customer shall be able to enter the start and end date of the transactions to be provided in the report. The maximum number of days for the search shall be a parameter settable by WMATA, which shall initially be set to 60 days. The reports shall be displayed to the customer and the customer shall have the capability to obtain the report output in pdf, Excel or hard copy form.

22.2.3.10 Employer Administrative Pages

Upon selection of the "Employer Administration" button from the CSA Start page, the user shall be prompted to enter the employer's login identification and password. When successfully logged in, the CSA shall present a series of employer administrative pages that shall enable authorized users to:

- Add new employees to the employer's table of benefit recipients;
- Delete employees from the displayed list of employees (As described the employee's entry in the data table shall not be deleted, but the employee status field shall be changed to indicate that the entry is no longer to be displayed);
- Modify the product an employee is to receive;

- Generate queries and reports of current and previous Smart Media orders and invoices;
- Submit payment to WMATA via EFT.

Employers shall be able to purchase for their employees only those products available for bulk purchase.

22.2.3.11 WMATA Administrative Pages

Access to these pages shall be restricted to authorized WMATA personnel using login and password protection. These pages shall not be accessible by a link on WMATA web site; authorized users shall be required to enter the secure web page address into their browser to gain access to the WMATA Administrative Login page.

Once a user logs into the WMATA Administrative pages, a menu shall be displayed to provide configuration control, administrative oversight, report and query generation, and other administrative tasks as required herein. Navigation around the administrative pages shall be straightforward, and shall be facilitated by the use of common buttons or tabs.

All WMATA administrative pages shall be cable of being restricted such that they may only be accessed by specified IP addresses.

22.2.4 Smart Media Telephone-Based Service

The NEPP shall include a modern state of the art Inbound Customer Support Call Center. This system shall utilize an Automated Call Director (ACD) and Interactive Voice Response System (IVR) with its telephone systems. Contractor shall provide a complete description of the hardware and software to be deployed for the ACD and IVR systems. **CDRL 22-6** The ACD shall automatically route each inbound call to the IVR for processing prior to routing calls to Customer Support Call Center (CSCC) staff upon request by a customer or upon presentation of a customer issue that the IVR is not equipped to handle.

The CSCC shall be located within the WMATA service area. Telephone calls in excess of the expected volumes shall be able to be accommodated at another location within the continental United States. All performance requirements shall apply for all activities. Contractor shall describe the plan for accommodating all NEPP CSCC traffic and shall submit it to WMATA for their review at PDR and for approval at FDR. **CDRL 22-7**

All customer payment data stored by for use within the CSS and applicable databases shall be compliant with the Payment Card Industry Data Security Standard (PCI DSS). All communications network components and devices utilized by the CSS shall comply with PCI DSS.

22.2.4.1 Interactive Voice Response System (IVR)

The IVR shall be used by the Contractor to identify the needs of the caller. Information such as customer account numbers shall be obtained from the caller in an automated manner. Answers to simple questions such as account balances or pre-recorded information shall be provided by the IVR without operator intervention. Account numbers from the IVR shall be compared to Caller ID data for security reasons and additional IVR responses shall be required if the caller ID data does not match the account record.

The IVR shall provide the capability for a customer to press a single key and have the last IVR prompt repeated, and shall provide the capability for a customer to request generic or menu-specific help from anywhere within the IVR menus. On invalid or no valid response, the IVR system shall have the capability to re-prompt the customer with a different message each time the prompt is spoken.

The IVR is required to provide customers with the option of speaking directly with a Customer Support Representative (CSR). When transferring to a CSR, the customer details shall be transferred with the call. There shall be no more than five options on a voice menu, and no more than two levels of IVR menu.

Recording of all IVR messages shall occur in a professional recording studio to ensure consistent volume levels as well as good speech quality. If Voice Recognition technology is used by the IVR, callers shall be connected to a live agent after two failed voice recognition attempts. New IVR callers need clear instructions on how to use the system. However, it is also important that frequent users can enter information as quickly as possible. The IVR system shall allow "type ahead," sometimes called "cut through," to permit users to enter data while the voice command is being spoken. Therefore, a frequent user would not have to wait until the end of "Please enter your account number" followed by hash, or "Wait on the line to be connected to an operator, BEEP," but could enter the account number in the middle of the sentence.

The IVR system shall be scalable such that phone lines can be easily added to the system as call volumes increase. Scalability shall include, but not be limited to, customer volume and network architecture. System shall provide support for multiple languages (including English and Spanish). System shall provide the capability for customers to leave a message after hours when no CSRs are available, and the ability for the customer to review their recorded message prior to submitting it.

The IVR shall create Call Detail Records (CDRs) for each customer call processed by the IVR. Call Details Records shall include all information to describe each IVR transaction. All Call Detail Records shall be transferred to the CDS.

On disconnection by the customer, or the IVR System, the System shall make the output line immediately available to other customers. System shall be able to support the goal of a 98% call capture rate and the goal to not exceed a 2% call abandon rate.

22.2.4.2 Customer Support Call Center (CSCC) Requirements

Customers shall access Customer Support for the NEPP accepted media by dialing a dedicated call-in number (actual number to be determined). The NEPP CSCC shall be capable of accepting both NEPP accepted and existing SmarTrip media Customer Support calls and initiating transfers to WMATA's existing Customer Service Department Telephone Support Line and SmarTrip RCSC automatically based on Customer entered information and responses to system prompts. The NEPP CSCC shall also be capable of accepting all incoming transfers from WMATA's existing Customer Service Department Telephone Support Line and SmarTrip RCSC.

Hours of operation shall match those of WMATA's Customer Service Department, which are currently 6:00 AM to 8:00 PM local time on weekdays and Saturdays, and 8:00 AM to 6:00 PM on Sundays and Holidays. WMATA will evaluate the NEPP Customer Support Center hours in the future, and may modify the operating hours and contract based on customer demand, as applicable.

WMATA anticipates very strong initial customer demand during the rollout of new Smart Media, which will likely diminish as customers become familiar with the program. Customer Support Center staffing should be responsive to these changing business conditions. The average number of seconds a customer shall spend waiting for a CSR to answer the phone after being placed in the queue by the IVR, shall not exceed 45 seconds between the hours of 6:00 AM and 8:00 PM on weekdays and two minutes at all other times.

The Customer Support Call Center system interface shall be designed to provide CSRs with an easy-to-use, user friendly, and intuitive graphical user interface (GUI). The System shall utilize a Computer Telephony Interface (CTI) and support a CTI-centric GUI. The System shall employ audible screen reader software to allow system displays to be readable and usable by blind users. The System shall support TTY calls using ADA-accepted methods for communications with the customer. The System shall support standard softphone features pertaining to queuing, call selection, and transfers. Features shall include but not be limited to the following:

- Support coordinated voice and data screen pops based on the customer's ID and route the call and data simultaneously to the appropriate agent;
- Support agent to agent communications including conferencing, attended transfers, and unattended/blind transfers.

Support the transfer of appropriate data invoked when the transferring agent received the call as well as new data added prior to call transfer.

Customer Support Center representatives shall be trained to complete calls within three minutes. Supervisors shall monitor CSR call lengths and shall log on for calls longer than the timeframes specified above.

CSRs shall assist customers as well as authorized agents from the Employer Transit Benefit and Preferred Vendor Sales programs routed from the IVR system with, at a minimum, the following issues:

A. Answers to questions regarding the NEPP Smart Media service;

B. Resolution of NEPP Smart Media related problems, such as media malfunctions, auto-replenishments, lost or stolen smart media;

C. Media replacement and value restoration requests, and verbal reports on the status of such requests;

D. Information on the unused value or calendar pass product remaining in a WMATA or Partner issued smart media account. Unused value information shall be as of the last data upload for remote inquiries;

E. The reporting and replacement of lost/damaged/stolen smart media;

F. Auto-replenishment set-up, modifications and discontinuance;

G. Add stored value or add pass transactions associated with a WMATA or a Partner issued smart media account;

H. Complaints and Discrepancies;

I. Prices for fare products;

J. Statements;

K. Balance Protection;

L. Group Fare Accommodations;

M. Refunds.

For the agents from the Employer Transit Benefit and Preferred Vendor Sales programs CSRs shall provide assistance with all aspects of the operation of the software used by these agents.

For each customer call transferred to a CSR, the Call Detail Record shall include details invoked during the interaction between the customer and the representative. All Call Detail Records shall be transferred to the CDS.

Customer Support Call Center Productivity shall be monitored and reported employing industry standard metrics such as the Call Center Performance Index. The Contractor shall also utilize other Performance and quality metrics designed to monitor and support performance.

Contractor shall recruit, train, manage and provide feedback to CSRs to ensure a professional representation of services delivered by WMATA to the public. The Contractor is a representation of WMATA. WMATA reserves the right to replace the customer support management operations if performance is not considered representative of WMATA.

22.2.4.3 Reporting Requirements

The Contractor shall provide standard and ad-hoc reports from the CDS for WMATA to monitor the customer service provided by the Contractor's Telephone-based Service. General requirements for these reports shall adhere to the general requirements as defined in Section 22.6. In addition, Telephone-based Service Reporting shall at a minimum, provide the following:

- Reports shall consolidate information from a variety of sources including:
    - ACD;
    - IVR;
    - Calls transferred from-to the IVR System.
- IVR reporting shall include the following reports:
    - Daily call count (total calls / day / hour of day);
    - Trunk utilization (number of trunks busy at once at 15 minute increments for a day;
    - Activity report (number of times callers performed specific activities in a given day by hour);
- The CSS shall be able to print all current system speech into a printed text format so it can be manually checked for accuracy;

- The CSS shall have a capability at a minimum, to print out a variety of reports that break down caller usage by the various IVR features, time of day, demographic area (by phone number), etc;

Draft reports shall be provided to WMATA for their review at PDR and for approval at FDR. **CDRL 22-8**

22.2.5 Employer Subsidized Smart Media Sales

It shall be possible for an organization to distribute a block of WMATA issued smart media in the name of the organization such as an employer. The organization shall be responsible for the association of employees to distributed WMATA issued smart media.

22.2.5.1 Employer Account Sign-up Process

Employers interested in participating in the subsidized smart media benefits program shall be able to apply via the CSA, through the mail or at the Customer Support Call Center.

22.2.5.2 Participating Employer Database

Upon satisfying WMATA's requirements for participation in the program, the system shall automatically create a record for the employer in the employer database table and create an empty Employer-Employee database table as described in Section 5.

For each participating employer, the CSA Database shall contain a record in the employer database table, and an Employer-Employee database table. The WMATA Administrative Web Pages shall include the necessary page or pages to maintain and update the employer database table.

22.2.5.3 Employer-Employee Database Table

The Employer-Employee database table is defined in Section 5.

<u>Initial Population</u>

Two methods shall be provided for the initial population of Employer-Employee database tables.

- The employer's transit benefit clerk shall be able to populate the table using the Employer Administrative web page to add new employee records one at a time.

- A file containing the necessary information, formatted as required in a spreadsheet or comma-delimited file shall be created by the employer and transmitted to WMATA's employer transit benefit liaison. Using the tool described in Section 5, the data shall be imported into the employer's Employer-Employee database table.

Ongoing Maintenance

Ongoing maintenance of the contents of the Employer-Employee database table shall be the responsibility of the employer's transit benefits clerk. For customer support purposes, WMATA's transit benefits liaison shall also have the ability to modify any employer's database tables.

While the web site shall be set up to automatically allocate the fare products to each of the employees' accounts, based on the smart media and periodicity identified for each employee, the employer shall have the ability to add, delete and change records in their Employer-Employee data base whenever required. The employer shall have full control over all of their records in their Employer-Employee database.

At the end of the day, all fare products allocated to the employees accounts shall be identified and an electronic payment shall be made to WMATA's bank. Each time fare products are allocated to an account, the amount owed shall be tallied to provide a grand total for the amount to be paid to WMATA for that day.

Each day that an employer provides transit payment to an employee's account, an electronic payment shall be made to WMATA's bank.

22.2.5.4 Employer Administrative Database Queries and Reports

The Employer Administrative web pages shall include database queries and reports sufficient to enable the employer to monitor and manage the transit benefits, track order, invoice, and payment status and history, and to project the cost of the next work order invoice.

22.2.5.5 Administrative Report and Query Functions

The WMATA transit benefit liaison shall be responsible for maintaining the employer database table, and shall be able to do so via Administrative web pages.

Given that all data from the CSA is synchronized with the NEPP Database, authorized users shall also be able to generate queries and reports from the CSA Database to monitor all E-Commerce management activities via the Report Manager on the Application Server of the CDS (See Section 16).

22.2.5.6 Employer Sales Processing

Employers shall provide payments to WMATA for the purchase of bulk smart media via Electronic Funds Transfer. Contractor shall assist WMATA personnel with all reconciliation processes.

22.2.6 Sales Fulfillment

Following all completed transactions, the CSA's E-Commerce segment shall publish all details that relate to the transaction to the CDS. The CDS, via the smart media Manager, shall generate work orders and verify that the order is fulfilled.

22.2.7 Preferred Vendor Sales Utility

The NEPP shall provide a web-based application to permit sales entities to provide smart media services. These sales entities will sign-up with WMATA, or its designated representative, to become an authorized sales and reload location for smart media. These sales locations shall not require any NEPP equipment but shall perform all functions through the web site using manual revenue collection processes.

Smart media functionality shall be accomplished via a secure web-utility. Once the user has signed in to the site, the following functionality shall be provided, based on user passwords, security protections and access privileges:

- Sell blank smart media and establish new smart media Transit Accounts;
- Sell blank smart media and assign to an existing Customer Profile;
- Add value to a smart media Transit Account;
- Add pass products to a smart media Transit Account;
- Set up automatic replenishment of smart media Transit Account; and

- Other functions as designated by WMATA.

Funds collected for all smart media sales shall be via the normal methods for the sales location. This web site shall provide a method for collection and transfer of funds associated with these transactions in an automated manner to a WMATA Transit Account.

At the end of the day, all fare products assigned to a WMATA or Partner issued smart media account by a Preferred Vendor shall be identified and an electronic payment for all transactions shall be made to WMATA's bank. Each time fare products are allocated to an account, the amount owed shall be tallied to provide a grand total for the amount to paid to WMATA for that day.

22.2.8 Media Distribution and Reload Network (MDRN)

The NEPP Contractor shall provide the ability for WMATA customers to purchase and reload Private Label WMATA Smart Media at retailers in the WMATA service area using an applicable third-party reload network. These locations shall not require any NEPP System equipment.

These sales entities will leverage their relationship with a reload network of the selected WMATA Smart Media technology to act as authorized sales and reload locations for Smart Media.

The following functionality shall be provided, at a minimum, to customers:

- Sell blank Smart Media;
- Add value to a Smart Media Transit Account;
- Add pass products to a Smart Media Transit Account.

MDRN locations must provide the capability to add value and passes to a Smart Media Transit Account; the sales of Smart Media is optional.

MDRN locations will have the option to charge a fee for this service to WMATA's Customers in accordance with the operating regulations, laws, etc. applicable to the WMATA Smart Media. All transactions and fees shall comply with all applicable federal, state, and local laws and regulations, and the fee structure shall be disclosed to customers prior to the completion of any transaction.

Customer fare payment transactions shall occur on a Pay-As-You-Go or a Pre-Funded basis depending upon the type of Fare Product loaded to the customer Transit Account.

All successful assisted and Customer self-directed reloads at MDRN locations shall be transmitted immediately to the NEPP System CDS.

Contractor shall ensure that all financial settlement between MDRN locations and WMATA shall occur through the transaction processing capabilities provided by Contractor through the system and components of the NEPP System.

WMATA requires next day settlement of all funds due from sales and reload transactions at MDRN locations.

Contractor shall configure the NEPP E-Commerce Web Site to support posting and accessing of information about all MDRN locations. Customers shall be able to access this information through standard features of web design, as detailed within this Technical Specification.

In addition, Contractor shall configure the NEPP System to support following specific functionalities for the E-Commerce Web Site:

- Display of locations according to multiple search criteria, including but not limited to street address, postal zip code, participating MDRN merchant name (i.e., as in the case of a retail chain), payment options, hours of operation, and distance from a given location;

- Display of locations on a geographic map with suitable, convenient, point-and-click convenient access to additional information about the MDRN location.

All data on MDRN locations shall be readily available to WMATA from the CDS, in easy to use electronic format, on an ad-hoc or recurring basis.

At a minimum, the number and geographic locations of MDRN locations must be twice the number and geographic locations of current WMATA SmarTrip fare media sales outlets.

Locations shall to the extent possible be situated within one-quarter mile of the nearest WMATA surface route stop or Metrorail station.

At the end of the day, all fare products assigned to a WMATA Smart Media Transit Account shall be identified and an electronic payment for all transactions shall be made to WMATA's bank. Each time fare products are allocated to a Transit Account, the amount owed shall be tallied to provide a grand total for the amount to paid to WMATA for that day.

MDRN locations must consistently and prominently display physical signage and messaging to Customers that indicates participation with WMATA. It shall be the responsibility of the Contractor to ensure that signage, messaging, and information regarding the MDRN for sale and reload of WMATA Smart Media is provided at each location. Signage shall also include information on WMATA fare structure, updated as needed based on fare changes.

Six months prior to end of warranty period, and for a period not to exceed three months after end of the warranty period, the Contractor shall execute a program to transition operation of the MDRN to WMATA control. As part of this transition program, the Contractor shall provide WMATA access to information and know-how that will enable WMATA to continue operation of the MDRN after the end of warranty period.

22.2.9 Parking Fee Payment via Cell Phone

Cell phones shall be able to be used for pay-by-space parking system payments. This payment methodology shall require the customer to pre-register and include a WMATA-approved payment method as part of their registration. Registration for this service shall be provided via the Internet as well as at the Customer Service Center.

All design requirements for the Customer Support System shall apply. The CDS shall provide all necessary software and hardware required for the incorporation of this payment methodology into the NEPP.

A complete description of this functionality shall be provided for WMATA review and approval at each design stage and shall include menu selections, screen layouts and other similar information to provide WMATA a complete understanding of the functionality. Design documents shall fully describe the functionality as defined for this function. **CDRL 22-9**

22.2.10 Customer Support Reporting

The Contractor shall provide standard and ad-hoc reports from the CDS for WMATA to monitor the Customer Support functions detailed within Section 22.2, Customer Support, in addition to the specific reports outlined within this Section. These reports shall provide WMATA with the daily, weekly, and monthly statistics on the Contractor's performance in all defined Customer Support functions. Customer Support Reporting shall adhere to the general requirements for reports as defined in Section 22.6. At a minimum, Customer Support reporting shall include, but not be limited to:

- Application processing statistics;
- Customer Support transaction statistics;
- Media Distribution and Reload Network (MDRN) transaction and distribution statistics.

22.3 Media Distribution Management

The Contractor shall distribute all media ordered by phone, through the NEPP CSA, or other WMATA-approved methodology. This includes distribution of Media to individual WMATA customers as well as to employer-sponsored accounts, retail sales locations and other venues. Distribution management includes the distribution of new and replacement smart media to customers.

22.3.1 Media Returns and Replacements

Defective smart media that fail due to no fault of the customer shall be replaced free of charge. Customers who lose or damage their smart media shall be assessed a replacement fee in accordance with WMATA policy. During the replacement process, these replacement smart media shall be automatically identified with the customers' accounts.

Contractor shall survey customer behavior and experience with the smart media to determine reasons for issuance of replacement smart media. All damaged, non-functional WMATA issued NEPP smart media shall be returned to WMATA for disposition. Contractor shall provide data in such a way as to assist WMATA in developing a NEPP smart media life cycle profile and determination of any manufacturing defects in the smart media.

22.3.2 Mail Distribution

WMATA issued NEPP smart media distributed by mail shall be available for use in the system upon activation by the customer. Customers shall receive notification with their smart media, that they shall activate the media either by calling the CSCC or via the CSA. If the customer has not called within a specified period of days, Contractor shall add the smart media serial number to the Invalid Smart Media List and Bad Number List. However, Contractor shall accept a verified smart media activation request and remove the smart media from the Invalid Smart Media List and Bad Number List at any time following.

Should the smart media be lost or stolen prior to activation by the customer, the smart media shall be added to the Invalid Smart Media List and the customer sent new media at no additional cost to the customer. The replacement smart media shall be automatically identified with the customer's account.

22.3.3 Internet Distribution

The WMATA NEPP CSA shall be capable of receiving customer smart media orders. Contractor shall fulfill all customer orders submitted via the CSA.

22.3.4 Media Distribution Management Reporting

The Contractor shall provide standard and ad-hoc reports from the CDS for WMATA to monitor the Media Distribution Management performance detailed within Section 22.3, Media Distribution Management, in addition to the specific reports outlined within this Section. These reports shall provide WMATA with the daily, weekly, and monthly statistics on the Contractor's performance in all defined Media Distribution Management requirements. Media Distribution Management Reporting shall adhere to the general requirements for reports as defined in Section 22.6. At a minimum, Media Distribution Management reporting shall include, but not be limited to:

- Media Returns and Replacement statistics;
- Mail Distribution statistics;
- Internet Distribution statistics.

22.4 Financial Management

The WMATA Finance Department will be responsible for all bank reconciliations that result from NEPP sales and reloads. WMATA personnel will also investigate all credit media charge-backs. Contractor will assist WMATA personnel with all reconciliation processes.

22.4.1 Service Center Reconciliation

Contractor shall reconcile all funds received through the mail on a daily basis. All funds received shall be transferred to WMATA's designated bank account prior to the end of each business day.

22.4.2 Refund Handling for Check/Cash Customers

Contractor shall process refunds based on WMATA's current fare policy. Refunds will be handled by the Customer Support Center in accordance with WMATA's policies on this issue.

Contractor shall work to resolve customer credit or debit media disputes related to NEPP media purchases or loads. If necessary, escalated disputes shall be referred to WMATA's Finance Department for resolution. No credits or adjustments shall be issued by the NEPP Customer Service Center outside of the refund process outlined in this chapter of the Technical Specification. Contractor shall respond to customer inquiries for information on recent credit activity associated with NEPP media or associated account. Contractor shall be responsible for security of information, and shall add to the Invalid Smart Media List and Bad Number List any smart media known to be or suspected of being purchased with and registered to stolen credit or debit media.

22.4.3 Reconciliation of Web-Based Revenues

The NEPP shall incorporate an application that tracks all web-based sales and employer revenue allocations to employee accounts and verifies that the payments have been provided to WMATA, as required.

For the Internet sales, the values of these sales shall be tracked and the electronic payment verified for each sale against the cleared payment. Missing payments shall be automatically identified and an exception report generated. All exception reports shall be provided on a daily basis, via email, to the designated WMATA representative.

For the employer transactions, at the end of each day, the all values assigned to accounts that day shall be summed and matched against payments. If there is a discrepancy between the amount owed and the amount of the electronic payment that day, the discrepancy shall be identified and reported as an exception, via email, to the designated WMATA representative as well as the contact identified for that employer.

These exception reports shall provide sufficient information to permit WMATA's representative to resolve the payment discrepancy.

22.4.4 Financial Management Reporting

The Contractor shall provide standard and ad-hoc reports from the CDS for WMATA to monitor the Financial Management performance detailed within Section 22.4, Financial Management, in addition to the specific reports outlined within this Section. These reports shall provide WMATA with the daily, weekly, and monthly statistics on the Contractor's performance in all defined Financial Management requirements. Financial Management Reporting shall adhere to the general requirements for reports as defined in Section 22.6. At a minimum, Financial Management reporting shall include, but not be limited to:

- Service Center Reconciliation statistics;
- Refund Handling for Check/Cash Customers statistics;
- Reconciliation of Web-Based Revenues statistics.

22.5 Performance and Staff Monitoring

Contractor shall supervise staff to meet the call center performance requirements including but not limited to wait times, call length, and customer satisfaction. All calls received into the call center shall be recorded. Supervisors shall monitor 10% of live calls and review 10% of each CSR's calls for feedback and performance evaluation. In order for WMATA to ensure that the Contractor provides a Customer Support System that meets the expectations of WMATA and the requirements as identified, defined and/or described within this entire Section, the Contractor shall provide the following for WMATA review and approval:

- A System Support Plan which includes the Staffing Plan and shall fully describe all of the elements of the Customer Support System and how all of its requirements shall be implemented by the Contractor;

- Fully developed and documented Procedures for operation of the entire Customer Support System, including all of its services and features; and

- Full design information documenting all system applications provided as a part of, integrated into and/or incorporated into the Customer Support System.

22.5.1 Performance Monitoring

The Contractor shall enable WMATA to monitor the performance of the NEPP Customer Support Center by reporting on Key Performance Indicators (KPI) in clearly measurable terms. The following levels of performance shall be met and demonstrated through ongoing data capture and reporting:

- Time of completion of smart media order (received via mail, internet). This time shall not exceed two business days after receipt of the order;

- Time for handling incoming mail requests (i.e. applications, information requests) and outgoing mail. This time shall not exceed two business days after receipt of the mail request;

- Average number of seconds a caller spends waiting for a CSR to answer the phone after being placed in the queue. This time shall not exceed 45 seconds between the hours of 6 a.m. and 8 p.m. weekdays. and two minutes at all other times;

- Availability of a CSR or the IVR to respond to customer calls. The wait time shall not exceed two minutes;

- Time between a reported lost/stolen smart media and the smart media being added to the Invalid Smart Media List and Bad Number List within the CDS. This time shall not exceed one hour between the hours of 6 a.m. and 8 p.m. weekdays, and two hours at all other times;

- Customer satisfaction rating of Support Center activities.

22.5.2 Staffing Plan

Contractor shall submit a Staffing Plan for WMATA to approve prior to implementation of the Customer Support Center. The plan shall be resubmitted for WMATA approval purposes quarterly during the warranty period of the NEPP Contract, and annually thereafter. The plan shall include organization charts and job descriptions by position for all Customer Support Center operations staff.

Contractor shall utilize a personnel policy for both permanent and temporary personnel. Contractor shall perform semi-annual performance evaluations for full-time permanent personnel.

Since Contractor staff will be handling WMATA and WMATA customer funds, criminal background checks on all employees shall be required.

Contractor shall be bonded for all customer care activities.

22.5.3 Performance and Staff Monitoring Reporting

The Contractor shall provide standard and ad-hoc reports from the CDS for WMATA to monitor the call center performance requirements detailed within Section 22.5, Performance and Staff Monitoring. These reports shall provide WMATA with the daily, weekly, and monthly statistics on the Contractor's performance in all defined call center performance requirements and shall include all Key Performance Indicators (KPI) statistics. Performance and Staff Monitoring Reporting shall adhere to the general requirements for reports as defined in Section 22.6.

22.6 General Reporting Requirements

The Contractor shall provide standard and ad-hoc reports from the CDS for WMATA to monitor the various Customer Support Services defined within this Section 22, provided by the Contractor. General requirements for these reports shall include, but not be limited to:

- An easy-to-use tool for use by managers and others with limited technical knowledge:
    - Reporting access shall be defined in accordance with various levels of authorization.

- Ability to select the frequency of report generation:
    - Daily;
    - Weekly;
    - Monthly;
    - Over a specified period or duration;
- Ability to automate the reporting process, or manually generate a report as needed, with a report period as desired;
- Ability to produce reports quickly as needed;
    - Ability to print and distribute reports locally, remotely from the CDS as well as from other authorized WMATA locations;
    - Ability to regenerate/reprint a report that has been previously generated.
- Ability to distribute reports through various media:
    - Manually, for printed reports;
    - By Fax;
    - Electronically (email).

The Contractor shall provide sample standard and ad-hoc reports for all Customer Support Services reporting requirements identified within this Section to WMATA for review at PDR and for approval at FDR. **CDRL 22-10**

22.7 Customer Support Services Option

WMATA, at its sole discretion, may opt to utilize WMATA staff and WMATA facilities to support the operations of the NEPP CSS. If WMATA decides to pursue this option, the Contractor shall be responsible for providing all the Customer Support systems, equipment, applications and utilities, tools, procedures, and manuals defined in this Section, necessary to provide all the functionalities defined within the scope of the Customer Support System.

As a part of this optional approach, the Contractor shall develop all supplemental applications and web-based utilities that interface with the Customer Services Application (CSA) (see Section 5) to support the NEPP CSS for all elements of, and in accordance with the requirements of:

- Media Base Management as defined in Section 22.1;
- Customer Support as defined in Section 22.2;
- Media Distribution Management as defined in Section 22.3;
- Financial Management as defined in Section 22.4; and
- Performance and Staff Monitoring as defined in Section 22.5.

The Contractor shall provide all equipment, devices, and tools, inclusive of all hardware and software required to provide the NEPP CSS functionality as defined in this Section including but not limited to:

- The production and distribution of personalized smart media as part of Photo-ID Media Management, the Reduced Fare Program, and the MetroAccess Program (see Section 22.1);
- The provision of all Internet-based service and the hosting of a secure web-based CSA to serve as the E-Commerce web site for the NEPP (see Section 22.2.3);
- The provision of a modern state of the art Inbound Customer Support Call Center with Automated Call Director (ACD); Interactive Voice Response System (IVR); Customer Support Call Center (CSCC) (see Section 22.2.4).

The Contractor shall provide all procedures, manuals, and documentation as defined within this Section to support the operations of the NEPP CSS. This shall include the provision of a complete System Support Plan and procedures to enable WMATA to monitor the performance of the NEPP Customer Support Center using Key Performance Indicators (KPI) as defined in Section 22.5.

22.8 Required CDRLs

The following CDRL items are referenced in this Section:

CDRL No.	Description	Section	Due	Approval Required
CDRL 22-1	Provide a full description of the plan for the transition of Customer Support Services and all associated hardware and software to WMATA control upon conclusion of the performance period	22	PDR, FDR	Yes
CDRL 22-2	Provide a full description of the architecture to be deployed for the NEPP Customer Support System	22	CDR, PDR, FDR	Yes
CDRL 22-3	Provide a complete description of the Auto Replenishment function	22.1.4	PDR, FDR	Yes
CDRL 22-4	Provide a complete description of the Application Processing function	22.2.1	PDR, FDR	Yes
CDRL 22-5	Provide a complete description of the design and functionality of all CSA web pages	22.2.3	PDR, FDR	Yes
CDRL 22-6	Provide a complete description of the hardware and software deployed for the ACD and IVR systems.	22.2.4	PDR, FDR	Yes
CDRL 22-7	Describe the plan for accommodating all NEPP CSCC traffic.	22.2.4	PDR, FDR	Yes
CDRL 22-8	Provide drafts of all standard and ad-hoc reports produced from the CDS.	22.2.4.3	PDR, FDR	Yes
CDRL 22-9	Provide a complete description of pay-by-space system Payment via Cell Phone functionality provided by the CDS.	22.2.9	CDR, PDR, FDR	Yes
CDRL 22-10	Provide sample standard and ad-hoc reports for all Customer Support Services reports produced from the CDS.	22.6	PDR, FDR	Yes

End of Section 22

Section 23 – System Support Services
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23 SYSTEM SUPPORT SERVICES

23.1 General

WMATA has identified several services to be performed in order to provide for the best and most efficient operation of the NEPP System. These services are envisioned as both options to and services included in the base NEPP System being deployed by WMATA as follows:

Table 23-1: NEPP System Services (Base and Options)

NEPP System Service	Start of Installation to Start of Warranty	During Warranty	After Warranty
Maintenance Services			
Preventive Maintenance	Included	Option	Option
Corrective Maintenance	Included	Included	Option
Revenue Servicing	Option	Option	Option
Extended Software Systems Support	N/A	N/A	Option
Management of Benefits Programs	Option	Option	Option
Smart Media Procurement	Option	Option	Option
NEPP Network Administration Services	Outsourced CDS only	Outsourced CDS only	Outsourced CDS only
Bankcard Processing Services	Option	Option	Option

The options for the Support Services identified in Table 23-1 may be exercised by WMATA or any of the Regional Partners for their specific NEPP System elements.

The ability to transition the responsibilities for the above Support Service to WMATA and to another WMATA-approved entity shall also be provided. Not less than thirty (30) days prior to the expiration of the performance period for a particular Support Service, 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, software, computers, applications, devices, tools and vehicles. Contractor will have the use of such items until that performance period expires.

23.1.1 Contractor Local Point-of-Contact

A local point-of-contact that can be contacted by WMATA personnel on a 24/7 basis for each of the exercised shall be provided 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. **CDRL 23-1**

23.2 Maintenance Services

WMATA expects that all of the NEPP equipment will be fully functional at all times. However, it is understood that there will be times when NEPP equipment may be out of service awaiting support from a repair technician. It is WMATA's intention to minimize the instance of these occurrences and to maximize Customer satisfaction with the NEPP System through use of a proactive maintenance program for all deployed NEPP System elements.

23.2.1 Maintenance Requirements

The Contractor shall maintain the NEPP System in accordance with the requirements of the maintenance manuals as defined in Chapter 20 of the Technical Specification. The Contractor shall provide all labor, materials and consumables.

Consumables shall not include Smart Media stock, toner for computer system printers and receipt stock. The Contractor shall also provide all tools, transportation, test equipment, personnel communications, facilities, and supervision to maintain the NEPP System.

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 as a result 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.

23.2.2 Responsibilities of the Contractor

Contractor responsibilities shall include the following maintenance tasks. These maintenance activities shall be based on the maintenance information provided in the maintenance manuals provided by the Contractor.

- Field and Bench-level Preventive Maintenance: Perform field and bench-level preventive maintenance on all devices and components installed as a part of the NEPP System.
- Field and Bench-level Corrective Maintenance: Perform all field and bench-level troubleshooting and repairs on all equipment installed as part of the NEPP System.
- Emergency Response: Respond on-site to calls from WMATA.
- Spare Parts Inventory Management: Manage the inventory of spare parts, materials and consumables that are required for the continued operation of the NEPP system and its devices.
- Software Maintenance and Upgrades: Repair, test and load existing, new, modified or upgraded software and data tables for the NEPP System and its installed devices.
- Technology Refreshment Services: Perform maintenance and provide software upgrades on all system devices and/or replace devices with new to ensure that all NEPP System devices will perform reliably in full revenue service.
- Task Order Work: Perform task order assignments as defined by WMATA (with the cost and schedule to be negotiated between the parties).

23.2.3 Technology Refreshment Services

From the time the first item of NEPP equipment is installed, the Contractor shall rigorously comply with the agreed maintenance program requirements to ensure that the NEPP System and all components attain the required useful life.

Prior to conclusion of the Contractor's maintenance responsibilities WMATA shall be able to, whenever desired, review all of the Contractor's maintenance records and NEPP equipment to verify the maintenance has been performed properly.

The Contractor shall, whenever required, update all third-party software to the most current applicable version. Exceptions for this update shall be at the discretion of and with the approval of WMATA.

23.2.4 Performance Requirements

The Contractor's performance shall be measured based on the extent to which the objectives below are achieved through satisfactory maintenance and technical support.

In order for WMATA to ensure that the Contractor provides Maintenance Services that meet the expectations of WMATA and fulfill the maintenance requirements as identified, defined and/or described within this Section 23, the Contractor shall provide the following for WMATA review and approval:

- A Maintenance Services Plan which shall fully describe all of the elements of the Maintenance Services and how all of its requirements shall be implemented by the Contractor **CDRL 23-2**; and
- Fully developed and documented procedures for all system maintenance provided **CDRL 23-3**.

System availability will be measured at the commencement of the peak period during each day as well as during off-peak periods as defined below.

An item of equipment will be judged as available if it is fully functional; that is, all patron features must be available for customer use. Failure of one of more functions to be available for customer use shall render the equipment to be either degraded or out-of-service. Equipment that is not fully functional shall be considered to be unavailable for purposes of calculating availability.

Equipment shall be excluded from the availability calculations if it is out of service due to the following external causes:

- Vandalism;
- Accidental damage caused by third-parties not associated with the Contractor;
- Acts of God which include: station flooding, tornados, rainstorms with driving winds, local earthquakes (moderate or greater), lightning strikes, fires, mudslides;

- Equipment out of service for preventive maintenance activity that requires downtime exceeding six (6) hours and for which the scheduled downtime is pre-approved by WMATA;

- Equipment out of service for retrofit or upgrade for which the scheduled downtime is pre-approved by WMATA;

- Equipment which is fully functional with the one exception of being unable to process Credit Media or Debit Media transactions due to faults occurring within a third-party communications networks or credit card transaction clearinghouse.

Equipment shall be considered “unavailable” if it is reported out of service by any party. Equipment identified as “unavailable” for the availability calculations will be those that are out of service or in degraded mode, due to causes that include all other problems except as identified above.

Maintenance on fare collection equipment shall be performed in such a manner as to provide for the following availability to meet AM rush hour requirements. (For purposes of maintenance, the AM rush hour is defined as from 6 AM through 9 AM).

- 99.5% availability by device type for all equipment located at the stations, garages, and NEPP equipment locations; and

- Not more than one of each type of equipment shall be out of service at any location.

Maintenance on fare collection equipment shall be performed in such a manner as to provide for the following availability to meet PM rush hour requirements. (For purposes of maintenance, the PM rush hour is defined as from 4 PM through 7 PM.)

- 99.5% availability by device type for all equipment located at the stations, garages, and NEPP equipment locations; and

- Not more than one of each type of equipment shall be out of service at any location.

Availability at all other times shall provide for no more than one of each type of NEPP equipment out of service at any location.

Access to all locations where NEPP System equipment and subsystems are installed shall be accessible for corrective maintenance except between midnight and 5 AM when all stations are closed and are generally inaccessible. No access shall be provided to these locations during the peak periods for preventive maintenance or equipment installation purposes. Peak periods are defined as Monday through Friday, 6 AM to 9 AM and 4 PM to 7 PM.

23.3 Revenue Services

The Contractor shall be responsible for revenue servicing of the NEPP System. The Contractor shall be responsible for revenue servicing all FVDs and other cash collecting devices within the WMATA transit services and (optionally) for Regional Partner transit services.

Revenue servicing activities to be provided shall include the following services in support of NEPP Equipment deployed:

- Cash Container Exchange;
- Smart Media/Receipt Stock Storage and Replenishment; and
- Third Party Payment Collection, Follow-up and Reconciliation.

For the Metro FVD cash container exchanges, the Contractor shall be responsible for:

- obtaining the replacement cash containers from a secure location at each station;
- exchanging the appropriate cash containers within the FVDs;
- obtaining the appropriate FVD internal reports;
- placing the exchanged cash containers in the secure location at the station, together with a copy of the appropriate FVD internal reports; and
- returning the remaining replacement cash containers to the secure location at the station.

Using the Money Train, WMATA will be responsible for:

- stocking the secure location at each station with the appropriate cash containers; and

- removing the exchanged cash containers and transporting them to the counting facility.

23.3.1 Smart Media Inventory Management

The Contractor shall procure Smart Media for the NEPP System on behalf of WMATA and for other Smart Media on behalf of Other Transit Agencies as defined in Section 2. The Contractor shall be fully responsible for securing and controlling its inventory of Smart Media. The Contractor shall maintain records that track the location of each item of Smart Media that has been consigned, while in secure storage, in transport, in NEPP equipment, and awaiting disposal. Unusable rolls/stacks or partial rolls/stacks of Smart Media tagged for disposal shall be secured until delivered to WMATA for destruction. A record of possession shall be maintained at all times.

The Contractor shall include the status of the Smart Media inventory with its end-of-month reports.

WMATA retains the right to audit and inspect the Smart Media inventory for the duration of the Contract.

23.3.2 Audits

WMATA intends to audit at least one item of NEPP equipment per week. This will entail removing all money and Smart Media, counting the money, and comparing the results to the contents that are reported by the CDS. The Contractor shall support this effort and this shall include (under WMATA observation):

- Remove the cash containers;
- Remove all Smart Media;
- Empty the coins from hoppers into a sealed bag;
- Inspect the NEPP equipment interior for coin, bills or Smart Media that may have fallen loose inside;
- Transport the removed contents to the Contractor cash counting facility;
- Count and record the contents, including money and Smart Media.

WMATA will compare the actual recorded contents to the contents expected based on CDS reports. Discrepancies shall be further investigated by WMATA as to cause.

23.3.3 Third Party Sales Management

As part of the revenue servicing, fare media distribution services shall be provided to third party retailers. The Contractor shall be responsible for the distribution of all Smart Media to all third-party and WMATA-operated sales locations as well as for the collection and reconciliation for all funds from those parties.

The Contractor shall be responsible for all activities for the management of those third party Smart Media distributors. Duties to be performed shall include:

- Service and assistance for third-party merchants;
- Smart Media order fulfillment and distribution;
- Funds collection;
- Revenue reconciliation; and
- NEPP sales terminal maintenance.

At the completion of each reconciliation, the revenues shall be deposited by the Contractor into WMATA's designated account. No revenues shall be held by the Contractor for a period exceeding twenty-four hours.

NEPP sales terminal maintenance shall require the replacement or repair of a defective NEPP sales terminal within a four hour period of notification by the third party sales location. This four hour correction period shall apply and accrue during normal business hours only (8:00 am through 5:00 pm) but for any day of the week.

23.3.4 Revenue Service Planning

Revenue Services shall cover only that equipment provided as part of the NEPP System. In order for WMATA to ensure that the Contractor provides Revenue Services that meet the expectations of WMATA and fulfill the revenue service and auditing requirements as identified within this Section 23.3, the Contractor shall provide a Revenue Services Plan for WMATA review and approval. **CDRL 23-4** This plan shall:

- Fully describe all of the elements of the Revenue Services to be provided as well as a description of how all of its requirements shall be implemented by the Contractor;
- Provide a complete description of the Smart Media Inventory Management system; and
- Include fully developed and documented procedures for all services identified within this Section 23.3.

23.3.5 Performance Requirements

The following requirements shall be achieved.

- All FVDs shall be revenue serviced prior to:
    - The bill vault reaching 90% of capacity;
    - The coin vault reaching 90% of capacity;
    - Any change unit being void of change for a period of more than two hours;
    - Depleted Smart Media stock for more than one hour;
- Third party sales offices shall be fully stocked by the first business day of each week. Orders shall be filled within 24-business hours of receipt of the order.
- Reconciliation of all revenues – manually counted versus as reported by the NEPP System – shall be not less than 99.75%.

23.4 Extended Software Systems Support

Subsequent to the conclusion of the Software Warranty affecting the NEPP equipment, WMATA will require Extended Software Systems Support. The Contractor shall provide on-site and remote technical support, system configuration and administration assistance, software development, and other services as described herein for a period of three years, with three additional two-year options. These options are exercisable at WMATA's sole discretion at any time prior to the conclusion of this contract and any previously exercised option.

During the initial three-year period of Extended Software Systems Support, the Contractor shall make available NEPP system software development, system administration, database administration, and other technical staff as necessary, for a total of 1,000 hours of direct labor. WMATA shall use this "bank" of labor hours on a task-order basis. If, prior to the conclusion of the three-year service period, tasks performed by the Contractor exhaust the 1,000-hour labor bank, WMATA may request additional hours of services, to be priced on a pro-rated hourly basis, up to a maximum of 1,500 total hours. Should WMATA request services beyond the maximum hours, the Contractor may do so at its discretion.

Any hours remaining in the labor bank at the conclusion of the Extended Software Systems Support services agreement (or any exercised option), shall remain available for WMATA use as described herein. For every month beyond the conclusion of the services agreement that labor bank hours remain unused, hours equal in value to the pro-rated fixed monthly fee for facilities maintenance shall be deducted from the labor bank.

23.4.1 Support Services to be Provided

The Contractor shall perform four basic categories of tasks as part of Extended Software Systems Support:

- Remote technical support;
- On-site technical support;
- Software development; and
- System migration to new computer Operating Systems and Relational Database Managers.

Remote Technical Support: The Contractor shall provide telephone-based technical support, Monday through Friday during normal business hours (8:00 AM through 5:00 PM Mountain Time) with an average two (2) hour response time. The Contractor shall provide telephone-based support at all other times, including weekends, holidays, and non-business hours with an average four (4) hour response time. Any support services initiated by WMATA outside of normal business hours shall consume the labor bank at 1.5 times the number of hours actually expended.

On-Site Technical Support: At WMATA's request, the Contractor shall supply technical support on-site at any WMATA office or maintenance facility, or where any WMATA NEPP equipment is installed. Qualified contractor staff shall be available to provide on-site support within 5 business days of the authorization of the task order. WMATA shall compensate the Contractor for direct travel and living expenses incurred by Contractor's staff while performing authorized task orders.

Software Development: Upon acceptance of a task order requiring modification of Contractor-developed NEPP software, the Contractor shall commence development of the requested software. The Contractor shall provide regular status updates, shall test the completed software, and shall assist WMATA as directed in the installation of the software change. All software development work performed under a task order issued by this contract shall be warranted by the Contractor against defects for a period of one (1) year after installation of the software. Labor required to correct defects in software developed under this contract shall not count against the labor bank.

System Migration: Within approximately two years of each major release of the OEM operating system and relational data base managers used as part of the NEPP CDS, WMATA may request the Contractor to migrate the respective portions of the CDS to the new OEM releases. At such times, WMATA shall request a quote from the Contractor for the labor required to modify, test, deploy, and document the migration of the CDS application software or database to the new OEM release. Upon acceptance of the ensuing task order, the Contractor shall perform the migration work, test the results, and deploy the upgraded CDS in a controlled fashion as approved by WMATA. All system migration work performed under a task order issued by this contract shall be warranted by the Contractor against defects for a period of one (1) year after installation of the software. Labor required to correct defects in system migration under this contract shall not count against the labor bank.

23.4.2 Contractor Personnel and Responsibilities

During the term of this contract, the Contractor shall:

- Retain technical support and software development personnel who are familiar with the NEPP System equipment and software, and who are qualified to perform the tasks described herein;

- Retain all software source codes and development and testing environments necessary to support and modify software for WMATA's NEPP System.

23.4.3 Task Order Procedures

WMATA shall identify those individuals authorized to call for remote technical support, and those individuals authorized to initiate task orders to the Contractor in writing.

When an authorized individual initiates a call for technical support, one half hour (30 minutes) of the labor bank shall be deducted as soon as the Contractor's technical support staff commences work on the request. If the request cannot be satisfied within 30 minutes, the Contractor shall only continue working on the issue under the direction of an individual authorized by WMATA to initiate task orders, and the formal task order procedure shall take effect.

Formal task order requests shall be initiated by WMATA in writing, by either email, FAX or other written correspondence. Upon receipt of the formal request, the Contractor shall provide a good faith estimate of the number of labor hours required to satisfy the request, the proposed start date/time for the effort, the individuals assigned to the task, and other relevant information; the Contractor shall provide the information in written form to the individual making the request. Upon acceptance of the estimate by WMATA, the Contractor shall commence work and notify WMATA upon successful conclusion of the task and the number of hours consumed.

Expended labor hours in excess of 50% over the approved task estimate shall not be counted against the labor bank; in such cases, the Contractor shall continue working until the task is completed. If the Contractor cannot or chooses not to complete the task, all hours expended on the task shall be "refunded" to the bank.

23.4.4 Labor Bank Accounting

Upon commencement of the Extended Software Systems Support services and each month thereafter, the remaining hours in the labor bank shall be decremented by the number of authorized hours expended (net of any "refunds").

Each monthly report shall document the number of hours remaining in the labor bank, and provide an accounting by task order and technical support request of the hours consumed, including the date, time, and individual authorizing the work.

23.4.5 Software Updates

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 of the base NEPP System software 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. No hours shall be deducted from the labor bank for these software updates.
- 24 months shall be added to the term of the contract;
- 1,000 hours shall be added to any unused hours in the labor bank; and
- 1,500 hours shall be added to the maximum hours available.

23.5 Management of Benefits Programs

Contractor shall be responsible for all aspects of management and support of the Transit Benefits, Employer, school and other programs which are a part of the NEPP System. This shall include:

- Solicitation and vetting of employers, schools and other entities;
- Processing all applications;
- Setting up all accounts;
- Verification of adherence to all WMATA regulations and rules by all entities; and

- Other activities as required to ensure proper setup of these Employer/Transit Benefit accounts.

In order for WMATA to ensure that the Contractor provides Benefits Program Management Services that meet the expectations of WMATA and fulfill the requirements as identified, defined and/or described within this Section 23.4, the Contractor shall provide the following for WMATA review and approval:

- A Benefits Program Management Plan which shall fully describe all of the elements of the Benefits Program Management to be provided as well as a description of how all of the NEPP System requirements shall be implemented by the Contractor **CDRL 23-5**; and

- Fully developed and documented Procedures for all support activities provided. **CDRL 23-6**.

23.6 Smart Media Procurement

Contractor shall be responsible for all aspects of procuring NEPP Smart Media. This shall include:

- Development/modification of procurement documents;

- Review of vendor procurements;

- Negotiations with vendors;

- Vendor selection;

- Receipt and storage of Smart Media;

- Inventory and related controls; and

- Other activities as required to obtain Smart Media.

In order for WMATA to ensure that the Contractor provides Smart Media Procurement Services that meet the expectations of WMATA within this Section 23.6, the Contractor shall provide the following for WMATA review and approval:

- A Smart Media Procurement Plan which shall fully describe all of the elements to be provided as well as a description of how this will be integrated into the NEPP System by the Contractor **CDRL 23-7**; and

23.7 NEPP Network Administration Services

If the CDS is installed at a WMATA-owned location, WMATA will operate and maintain the network.

Should WMATA accept an outsourced CDS for the NEPP, the Contractor shall provide for all Network Administration Services to ensure that the NEPP System meets the specified operating requirements and is maintained in a state of good repair.

In order for WMATA to ensure that the Contractor provides Network Administration Services that meet the expectations of WMATA and fulfill the network support requirements as identified, defined and/or described within this Section 23.4, the Contractor shall provide the following for WMATA review and approval:

- A Network Administration Services Plan which shall fully describe all of the elements of the Network Support Services to be provided as well as a description of how all of the NEPP System requirements shall be implemented by the Contractor **CDRL 23-8**; and

- Fully developed and documented Procedures for all network support activities provided **CDRL 23-9**.

23.8 Bankcard Processing Services

WMATA desires that the Contractor provide Bankcard Processing Services from start of Revenue Service up to the conclusion of the NEPP System Warranty period. These services shall include a contract with a financial institution or a financial services processor to function as an acquirer/processor to securely collect and process bank issued credit and debit media transactions in accordance with industry standards.

In order for WMATA to ensure that the Contractor provides Bankcard Processing Services that meet the expectations of WMATA and fulfill the requirements as identified, defined and/or described within this section, the Contractor shall provide the following for WMATA review and approval:

- A Services Plan which shall fully describe the Bankcard Processing Services being provided, including metrics such as staffing, response times, fees and other similar elements. The Plan shall also include a description of how all of these requirements shall be implemented by the Contractor **CDRL 23-10**; and

- Fully developed and documented Procedures for all credit and debit processing activities provided. **CDRL 23-11**

The financial institution/processor shall transmit the transactions to the various credit and debit networks and act as the settlement agent for all bank issued credit and debit transactions.

Financial institutions/processors shall be ISO 8583 compliant, use triple Data Encryption Standard (3 DES) and adhere to ANSI X9 encryption standards. PCI DSS requirements shall be maintained at all times.

WMATA requires that financial institutions/processors incorporate cardholder data protection systems within their systems, which surpass the requirements of on-going PCI-DSS compliance in order to minimize and/or eliminate the data security breach liabilities of WMATA.

Modifications to accommodate changes to the applicable standards shall also be performed.

23.9 Required CDRLs

The following CDRL items are referenced in this Section.

CDRL No.	Description	Section	Due	Approval Required
23-1	Contractor Local Point-of-Contact information and schedule	23.1.1	Monthly	No
23-2	Maintenance Services Plan	23.2.4	PDR, FDR	Yes
23-3	System Maintenance Procedures	23.2.4	PDR, FDR	Yes
23-4	Revenue Services Plan	23.3.4	PDR, FDR	Yes
23-5	Benefits Program Management Plan	23.5	PDR, FDR	Yes
23-6	Management of Benefits Program	23.5	FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
	Support Procedures			
23-7	Smart Media Procurement Plan	23.6	PDR, FDR	Yes
23-8	Network Administration Plan	23.7	PDR, FDR	Yes
23-9	Network Administration Procedures	23.7	FDR	Yes
23-10	Bankcard Processing Services Plan	23.8	PDR, FDR	Yes
23-11	Bankcard Processing Services Procedures	23.8	FDR	Yes

End of Section 23

Section 24 – Contract Deliverable Requirements List
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24 Contract Deliverable Requirements List 24-1

24 CONTRACT DELIVERABLE REQUIREMENTS LIST

CDRL No.	Description	Section	Due	Approval Required
1-1	Provide a transition plan to move from the present SmarTrip® system to the new NEPP System.	1.5	CDR, PDR, FDR	Yes
2-1	Local, state, or national codes, ordinances, statutes, standards, and federal rules and regulations applicable to NEPP System	2.2	PDR	Yes
2-2	NEPP System compliance with PCI-DSS	2.2.1	PDR, FDR	No
2-3	Existing WMATA systems which are impacted by the NEPP System that are not PCI compliant	2.2.1	PDR	No
2-4	NEPP System compliance with PA-DSS	2.2.2	PDR, FDR	No
2-5	Additional applicable PCI standards, Information Supplements and Guidelines	2.2.3	NTP + 90 days	No
2-6	System Security Plan	2.3.1	NTP + 90 days	Yes
2-7	List of all replaceable modules	2.3.5	PDR	Yes
2-8	Samples of all safety graphics	2.3.8	PDR, FDR	Yes
2-9	Equipment UL certifications	2.3.13	FAT completion	No
2-10	Conductor identification	2.3.13.2.6	CDR	Yes
2-11	Identification methodology of equipment and components	2.3.13.2.6	CDR	Yes
2-12	Versions of third party commercially available software	2.3.17	FDR	Yes
2-13	Method for addition, alteration, or deletion of hardware, software, or telecommunications	2.3.17.7	CDR	Yes

CDRL No.	Description	Section	Due	Approval Required
2-14	Software Configuration Control Plan	2.3.17.7	FDR	Yes
2-15	Final software configuration for each NEPP device in electronic format	2.3.17.7	System Acceptance	Yes
2-16	Software error code modification methodology	2.3.17.9	PDR, FDR	Yes
2-17	Software Development Tools Updates	2.3.17.10	As needed	No
2-18	Definition of the software documentation methodology	2.3.17.11	CDR	Yes
2-19	Bad number list format, size, refresh frequency and characteristics	2.3.18.1	PDR, FDR	Yes
2-20	Invalid smart media list format, size, refresh frequency and characteristics	2.3.18.2	PDR, FDR	Yes
2-21	Positive list format, size, refresh frequency and characteristics	2.3.18.3	PDR, FDR	Yes
2-22	Processes for downloading software updates	2.3.20	PDR	Yes
2-23	Preventive Maintenance Matrix	2.7.1	PDR	Yes
2-24	Corrective Maintenance Matrix	2.7.2	PDR	Yes
2-25	Smart Media specifications	2.8.A	Completion of initial installation	No
2-26	Smart Media encoding schema	2.8.B	System Acceptance	No
2-27	Interface Protocols and definitions of message structure	2.8.D	System Acceptance	No
3-1	Smart Media Technology	3.0	CDR, PDR	Yes

CDRL No.	Description	Section	Due	Approval Required
3-2	Licenses for the approved acceptable technology for WMATA	3.0	at Final Acceptance	No
3-3	Validity checking steps performed by the PPT for each fare type	3.0	PDR, FDR	Yes
3-4	Certification documents for the PPT and Smart Media Dispenser Module	3.1	PDR	Yes
3-5	Certificates confirming that the WMATA Smart Media meets ISO/IEC-14443 and open standard payment platform requirements	3.1	PDR	Yes
3-6	Certification of fully compliant with EMV Contactless Specifications	3.1.1	10 days after certification completed	No
3-7	EMV recertification	3.1.1	When software changes (prior to warranty completion)	No
3-8	EMV recertification	3.1.1	As needed (prior to warranty completion)	No
3-9	PPT hardware and software information	3.1.1	CDR, PDR	Yes
3-10	Smart Media security measures	3.2.1	FDR	Yes
3-11	Description of processing for each type of media	3.2.2	CDR, FDR	Yes
3-12	Approach for development and application of serial numbers,	3.2.2	CDR, FDR	Yes
3-13	Magnetic and microprocessor data to be encoded and stored on the Smart Media	3.2.2	PDR, FDR	Yes
3-14	Detailed information on all details regarding each type of LUM provided	3.2.3	CDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
3-15	Data to be encoded on the WMATA LUM	3.2.3	CDR, FDR	Yes
3-16	Method of commercially available, open standard end-to-end encryption	3.3	CDR, FDR	Yes
3-17	Set of transactional information proposed for Smart Media traceability	3.4	CDR, FDR	Yes
3-18	Detailed description of the Smart Media tracking system	3.4	FDR	Yes
4-1	Provide full details for bankcard processing parameters, including suggested settings and rationale.	4.1.3.1	CDR, PDR, FDR	Yes
4-2	Provide proposed process and schedule for initial PIN Pad injections,	4.1.3.4	PDR	Yes
4-3	Provide a functional description of all replenishment methods including the design or the operational flows, screens, functions and other similar information.	4.1.4	PDR, FDR	Yes
4-4	Provide fare pricing matrix to meet the requirements of each transit service as identified in Section 1 that shows how each transaction shall be priced for payment purposes	4.2	CDR, FDR	Yes
4-5	Provide complete information on all risk mitigation features and functions provided for the payment processing, including security measures implemented.	4.4	PDR, FDR	Yes
4-6	Provide complete information on the fraud detection and identification features provided for the payment processing, including security measures implemented.	4.4.2	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
4-7	Provide complete information on the orphan mode, including additional security measures implemented.	4.4.4	PDR, FDR	Yes
4-8	Provide full details for the chargeback processing methodologies and procedures.	4.4.5	PDR, FDR	Yes
4-9	Provide full details on payment processing parameters, including the proposed settings as a part of the Final Design Review.	4.6.1	PDR, FDR	Yes
5-1	Provide information on all design aspects of the Contractor-developed web pages.	5.1.1.1.2	PDR, FDR	Yes
5-2	Provide information on Contractor and WMATA identified additional links to WMATA web pages or other web pages.	5.1.1.1.3	PDR, FDR	Yes
5-3	Provide full information on all databases utilized for the CSA applications	5.1.1.1.10	CDR, PDR, FDR	Yes
5-4	Provide samples of Mobile Inspection reports.	5.2.2.1	PDR, FDR	Yes
5-5	Provide information on structure and layout of all cash transaction records of Mobile Sales.	5.2.2.2	PDR, FDR	Yes
5-6	Provide information on structure and layout of all credit transaction records of Mobile Sales.	5.2.2.2	PDR, FDR	Yes
5-7	Provide samples of Mobile Sales reports.	5.2.2.2	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
5-8	Provide a complete description of Parking via Mobile Devices functionality, including menu selections, screen layouts and other similar information to provide WMATA a complete understanding of the functionality.	5.2.2.4	CDR, PDR, FDR	Yes
6-1	Complete description of FVD functionality	6.1	CDR, PDR, FDR	Yes
6-2	Complete description of each FVD type's physical characteristics	6.1.1	PDR	Yes
6-3	All configuration and parameter settings	6.1.1	PDR, FDR	Yes
6-4	Details for all transaction records	6.2	PDR, FDR	Yes
6-5	Data dictionary	6.2	CDR, PDR, FDR	Yes
6-6	Information to be printed on vouchers and receipts for cancelled transactions	6.2.2	PDR, FDR	Yes
6-7	Displayed information and screen layouts for all transactions and messages	6.3.1	PDR, FDR	Yes
6-8	Selection of voices for audio system	6.3.4	PDR, FDR	Yes
6-9	Conceptual description of instructional graphics	6.3.5	PDR	Yes
6-10	Format and content of each local FVD report	6.4	PDR, FDR	Yes
6-11	Information for the software and parameters for the backup power system	6.14.8	PDR, FDR	Yes
6-12	Encryption methodology for all the communications between the FVD and CDS	6.13	CDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
6-13	Coin Recirculating System function and hardware	6.17	CDR, PDR, FDR	Yes
6-14	Coin Recirculating System function and hardware	6.18	CDR, PDR, FDR	Yes
7-1	Complete description of faregate functionality	7.1	CDR, PDR, FDR	Yes
7-2	Complete description of each fareate type's physical characteristics	7.1	CDR, PDR	Yes
7-3	All configuration and parameter settings	7.1	PDR, FDR	Yes
7-4	Text displayed by the faregate	7.2	PDR, FDR	Yes
7-5	Structure and layout of all transaction records	7.2	PDR, FDR	Yes
7-6	Text and fixed graphics	7.3	PDR, FDR	Yes
7-7	Wording of messages	7.3.3	PDR, FDR	Yes
7-8	Proposed tones and volumes	7.3.4	PDR	Yes
7-9	Alarm volume control	7.4.2	PDR	Yes
7-10	Customer sensors	7.4.2	PDR, FDR	Yes
7-11	Smart Media acceptance during communication failure	7.5	PDR, FDR	Yes
7-12	Data communications methodology and downloaded information	7.5.1	PDR, FDR	Yes
7-13	Design of the ADA faregate and barrier	7.8	PDR	Yes
7-14	Installation drawings and prerequisites	7.9	PDR, FDR	Yes
8-1	Complete description of turnstile functionality	8.1	CDR, PDR, FDR	Yes
8-2	Complete description of the turnstile's physical characteristics	8.1	CDR, PDR	Yes

CDRL No.	Description	Section	Due	Approval Required
8-3	All configuration and parameter settings	8.1	PDR, FDR	Yes
8-5	Text displayed by the turnstile	8.2	PDR, FDR	Yes
8-6	Structure and layout of all transaction records	8.2	PDR, FDR	Yes
8-7	Text and fixed graphics	8.3	PDR, FDR	Yes
8-8	Wording of messages	8.3.3	PDR, FDR	Yes
8-9	Proposed tones and volumes	8.3.4	PDR	Yes
8-10	Smart Media acceptance during communication failure	8.5	PDR, FDR	Yes
8-11	Data communications methodology and downloaded information	8.5.1	PDR, FDR	Yes
8-12	Installation drawings and prerequisites	8.8	PDR, FDR	Yes
9-1	Complete description of faregate functionality	9.1	CDR, PDR, FDR	Yes
9-2	Complete description of each faregate type's physical characteristics	9.1	CDR, PDR	Yes
9-3	All configuration and parameter settings	9.1	PDR, FDR	Yes
9-2	Text displayed by the faregate	9.3	PDR, FDR	Yes
9-5	Structure and layout of all transaction records	9.3	PDR, FDR	Yes
9-6	Text and fixed graphics	9.4	PDR, FDR	Yes
9-7	Wording of messages	9.4.3	PDR, FDR	Yes
9-8	Proposed tones and volumes	9.4.4	PDR	Yes
9-9	Alarm volume control	9.5.2	PDR	Yes
9-10	Customer sensors	9.5.2	PDR, FDR	Yes
9-11	Smart Media acceptance during communication failure	9.6	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
9-12	Data communications methodology and downloaded information	9.6.1	PDR, FDR	Yes
9-13	Installation drawings and prerequisites	9.10	PDR, FDR	Yes
10-1	Complete description of OBPT functionality	10.1	CDR, PDR, FDR	Yes
10-2	Dimensioned drawings	10.1	CDR, FDR	Yes
10-3	Messages displayed, triggers and wording	10.1	PDR, FDR	Yes
10-4	Sounds and sound patterns	10.6.3	PDR	Yes
10-5	Data Dictionary	10.6.5.5	PDR, FDR	Yes
10-6	Details of the configuration changes, communication interface and data transfer	10.7	FDR	Yes
10-7	Details of all security provisions and latching schemes	10.8	PDR	Yes
10-8	Design of wiring terminations and harness interconnections	10.9	FDR	Yes
10-9	Location and mounting positions and methods of the OBPT	10.9	PDR, FDR	Yes
11-1	Complete description of PV functionality	11.1	CDR, PDR, FDR	Yes
11-2	Complete description of the PV physical characteristics	11.1	CDR, PDR	Yes
11-3	Configuration and parameter settings	11.1	PDR, FDR	Yes
11-4	Designs of the PV fixed instructions and related graphics	11.3	PDR	Yes
11-5	Sounds and sound patterns for the audible messaging system	11.3.5	PDR	Yes
11-6	Data dictionary	11.4.4	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
12-1	Provide conceptual drawings of the HSD showing configuration, displays, and controls seated in charging/data cradles, in the holsters and held in a hand.	12.2.1	PDR	Yes
12-2	Provide HSD hardware and software design, the functions provided, the procedures for Smart Media processing and the allocation of push buttons for each HSD and HSD printer function.	12.2.1	PDR, FDR	Yes
12-3	Provide the HSD operating system details.	12.2.2	PDR, FDR	Yes
12-4	Provide all HSD display prompts, instructions, displays, message formats, sample character fonts, and contents.	12.2.4	PDR, FDR	Yes
12-5	Provide all audible tones to be used for key presses of the QWERTY style keyboard within the HSD touch-screen display.	12.2.5	PDR, FDR	Yes
12-6	Provide samples of all reports produced with the HSD mobile applications.	12.4	PDR, FDR	Yes
12-7	Provide the structure, layout, and display of the records and data stored by the HSD.	12.6	PDR, FDR	Yes
12-8	Provide the complete design of the HSD holster.	12.9	PDR	Yes
12-9	Provide the summary and transactional data to be stored by the HSD, such as fares accumulated by customer type, payment type, media type, and other categories as required by WMATA.	12.10	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
13-1	Provide a complete description of the functionality of CST with sufficient detail to permit verification that all required functions are satisfactorily included.	13.1	CDR, PDR, FDR	Yes
13-2	Provide all information on the hardware and peripherals for the sale device elements of the CST.	13.3	CDR, FDR	Yes
13-3	Provide details on the CST fare table configuration, set-up, and capacities.	13.4	PDR, FDR	Yes
13-4	Provide the general architecture of the CST, including CPU and bus speeds, memory size and speed.	13.5	PDR	Yes
13-5	Provide a complete description of the CST operation with sufficient detail to permit verification that all required functions are satisfactorily included.	13.5	CDR, PDR, FDR	Yes
13-6	Provide all configuration and parameter settings for the CST.	13.5	PDR, FDR	Yes
13-7	Provide dimensioned drawings of the CST showing configuration, displays, and controls.	13.5	PDR	Yes
13-8	Provide the allocation of the buttons for each of the CST functions.	13.6	PDR, FDR	Yes
13-9	Provide a complete description of all CST peripherals with sufficient detail to permit verification that all required functions are satisfactorily included.	13.7	CDR, PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
13-10	Provide dimensioned drawings of the CST and all peripherals, showing configuration, displays, and controls.	13.7	FDR	Yes
13-11	Provide samples of all reports produced by the CST.	13.8	PDR, FDR	Yes
13-12	Provide a complete description of the functionality of the PCST with sufficient detail to permit verification that all required functions are satisfactorily included.	13.11.1	CDR, PDR, FDR	Yes
13-13	Provide a complete description of the Mobile CST Cabinet.	13.11.2	CDR, PDR, FDR	Yes
14-1	Complete description of PLP functionality	14.1	CDR, PDR, FDR	Yes
14-2	Complete description of the PLP physical characteristics	14.1	CDR, PDR	Yes
14-3	Configuration and parameter settings	14.1	PDR, FDR	Yes
14-4	Data Dictionary	14.4.4	PDR, FDR	Yes
15-1	Provide Network Configuration Plan detailing the Contractor's intended approach for network architecture and design, inclusive of details regarding System Capacity and System Availability.	15.1.1	CDR, PDR, FDR	Yes
15-2	Provide the electronic file format to be utilized for fiber Optic cable Optical Time Domain Reflectometer (OTDR) tests performed.	15.1.3.1	PDR	Yes
15-3	Provide all information and technical specifications on fiber optic cabling to be installed.	15.1.3.1	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
15-4	Provide all information and technical specifications on all distribution shelves to be installed.	15.1.3.2	PDR, FDR	Yes
15-5	Provide details regarding all types of Fiber Optic Connectors to be installed.	15.1.3.3	PDR, FDR	Yes
15-6	Provide all information on all transmission equipment be installed.	15.1.3.4	PDR, FDR	Yes
15-7	Provide a complete description of all NEPPWC elements in conjunction with the Network Management Plan.	15.1.4	CDR, PDR, FDR	Yes
15-8	Provide a complete description all Commercial Wireless Broadband communications to be provided. Provide sufficient detail to permit verification that all required functions are satisfactorily included.	15.1.4.2	CDR, PDR, FDR	Yes
15-9	Provide all information and technical specifications on all wireless access points to be installed.	15.1.4.3	CDR, FDR	Yes
15-10	Provide a complete description of all leased lines. Provide sufficient detail to permit verification that all required functions are satisfactorily included.	15.1.5	CDR, PDR, FDR	Yes
15-11	Provide all information and technical specifications on any miscellaneous equipment to be installed.	15.1.6	CDR, FDR	Yes
15-12	Provide all information and technical specifications on all enclosures to be installed.	15.1.7	CDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
15-13	Provide details regarding the selected network communications protocol utilized within the NEPPCN.	15.2	PDR	Yes
15-14	Provide details, information, technical specifications, and certifications for all communications hardware to be used within the NEPP and integrated into the WMATA environment.	15.2	PDR, FDR	Yes
15-15	Provide details regarding Network Addressing Plan for all devices on the NEPPCN to supplement MetroNet's IP network addressing scheme as necessary.	15.2.1	PDR, FDR	Yes
15-16	Provide the NEPPCN design within and external to the MetroNet infrastructure, including installation and equipment details.	15.2.2	PDR, FDR	Yes
15-17	Provide the design and installation plan, including document and drawings, of each station and facility LAN, including architecture, physical arrangement, and details of all necessary hardware.	15.2.2.1	CDR, PDR	Yes
15-18	Provide the final design for the installation of equipment within the station LAN, in station and facility specific packages.	15.2.2.1	FDR	Yes
15-19	Provide the design for all NEPP wireless communications applications, installations and implementations.	15.3	CDR, PDR, FDR	Yes
15-20	Provide details regarding the use of wireless broadband communications, including architecture, physical arrangement, and all necessary hardware	15.3.1	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
15-21	Provide details and certifications for the Wireless Broadband Communications system for fixed location devices.	15.3.1.1	PDR, FDR	Yes
15-22	Provide site specific details regarding the configuration, placement, and installation of communications hardware.	15.3.1.1	PDR, FDR	Yes
15-23	Provide details regarding the use of Local Wireless Communications, including architecture, physical arrangement, and all necessary hardware.	15.3.1.1	PDR, FDR	Yes
15-24	Provide details and certifications for the Wireless Broadband Communications system for the On-Board Processor.	15.3.2.1	PDR, FDR	Yes
15-25	Provide details regarding the use of Local Wireless Communications, including architecture, physical arrangement, and all necessary hardware for the On-Board Processor.	15.3.2.1	PDR, FDR	Yes
15-26	Provide details, information, technical specifications, and certifications for the Wireless Broadband Communications system for fixed location devices.	15.3.2.2	PDR, FDR	Yes
15-27	Provide details regarding the use of Local Wireless Communications, including architecture, physical arrangement, and all necessary hardware for fixed location devices.	15.3.2.2	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
15-28	Provide full information for all hardware and software for WMATA's business recovery site.	15.4	PDR, FDR	Yes
15-29	Provide descriptions of how physical security compliance has been attained for PCI DSS.	15.5.2	CDR, PDR, FDR	Yes
15-30	Provide supporting documentation to certify that the system meets the PCI DSS requirements.	15.5.2	CDR, PDR, FDR	Yes
16-1	Provide a complete description of the functionality of the CDS at each stage of the design review with the final document fully describing the operation, capabilities, and functionality of the CDS. Provide sufficient detail to permit verification that all required functions are satisfactorily included.	16.1	CDR, PDR, FDR	Yes
16-2	Provide licenses for all third party software and core software in accordance with requirements stated in the Contract. Identify all third party software and provide WMATA a listing of all software applications and tools used within the CDS.	16.2	PDR	Yes
16-3	Provide the overall system architecture design.	16.3	CDR, PDR	Yes
16-4	Provide technical details and specifications on the database engine selected for the CDS.	16.3	PDR, FDR	Yes
16-5	Provide a description of how the system performs archiving of all transaction data and critical core software to secure media without user intervention, at user programmable time periods.	16.3	FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
16-6	Provide details and information on the data redundancy scheme employed.	16.3.3	PDR, FDR	Yes
16-7	Provide details and information on the data backup and archiving schemes employed.	16.3.4	PDR, FDR	Yes
16-8	Provide all technical details of the process by which the primary and secondary instances of the CDS shall function and communicate to support the Disaster Recovery requirements for the CDS.	16.3.5	PDR, FDR	Yes
16-9	Provide final design details, including server manufacture, model, and other hardware selections used with the CDS.	16.4.1	FDR	Yes
16-10	Provide data included and format provided for the daily summary tables automatically generated from the detailed transaction detail by the CDS.	16.4.2.1	PDR, FDR	Yes
16-11	Provide a plan for the migration of all WMATA historical data from WMATA's existing legacy and business systems to the CDS.	16.4.2.7	PDR	Yes
16-12	Provide a plan for time synchronization of all NEPP field devices with the CDS as set by the Domain Controller.	16.4.4	PDR	Yes
16-13	Provide the general design of input forms for all information to be entered by system users.	16.5.1	PDR	Yes

CDRL No.	Description	Section	Due	Approval Required
16-14	Provide a functional description of all monitoring functions provided by the CDS. This information shall include the design or the operational flows, screens, functions and other similar information and shall included increasing detail with each design review step.	16.6	CDR, PDR, FDR	Yes
16-15	Provide a functional description of all security functions, including virus protection. This information shall include the design or the operational flows, screens, functions and other similar information and shall included increasing detail with each design review step.	16.8	PDR, FDR	Yes
17-1	Provide description and details of the Interface Control Document (ICD)	17.1	CDR	Yes
17-2	Provide a complete ICD at the completion of each phase and a copy to the software escrow.	17.1	Completion of each project Phase; Software Escrow	Yes
17-3	Provide descriptions of all business and legacy system interfaces for the NEPP.	17.2	CDR	Yes
17-4	Provide full information for System Interfaces of business and legacy system interfaces for the NEPP.	17.2	PDR, FDR	Yes
17-5	Provide an initial list of alarm conditions to be transmitted to WMATA's Transit Police force.	17.2.2.3	FDR	Yes
17-6	Provide identification and definition of all NEPP System APIs to be developed.	17.3	CDR	Yes

CDRL No.	Description	Section	Due	Approval Required
17-7	Provide one (1) complete set of APIs to WMATA	17.3	Completion of each project Phase; Software Escrow	Yes
17-8	Provide full description of all NEPP APIs.	17.3	FDR	Yes
17-9	Provide full design information of all NEPP System APIs and their constituent elements.	17.3	FDR	Yes
17-10	Provide detailed processes and procedures to WMATA to permit certification of other companies/suppliers	17.3.1	PDR, FDR	Yes
17-11	Provide full definitions of system interfaces and all data flows required to support Metrorail Operations within the CDS.	17.4.1.1	PDR, FDR	Yes
17-12	Provide full definitions of system interfaces and all data flows required to support Metrobus Operations within the CDS.	17.4.1.2	PDR, FDR	Yes
17-13	Provide full definitions of system interfaces and all data flows required to support Parking Operations within the CDS.	17.4.1.3	PDR, FDR	Yes
17-14	Provide full definitions of system interfaces and all data flows required to support MetroAccess Operations within the CDS.	17.4.1.4	PDR, FDR	Yes
17-15	Provide full definitions of system interfaces and all data flows required to support the Maximo Asset Management interface with the CDS.	17.4.2	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
17-16	Provide full definitions of system interfaces and all data flows required to support Treasury Sales and Fare Media Operations within the CDS.	17.4.3.1	PDR, FDR	Yes
17-17	Provide full definitions of system interfaces and all data flows required to support Treasury Revenue Operations within the CDS.	17.4.3.2	PDR, FDR	Yes
17-18	Provide full definitions of system interfaces and all data flows required to support Budget Operations within the CDS.	17.4.4.1	PDR, FDR	Yes
17-19	Provide full definitions of system interfaces and all data flows required to support all elements of Operations Planning and Support within the CDS.	17.4.4.2	PDR, FDR	Yes
18-1	Submit the NEPP Management Plan.	18.1.2	Within 30 days after NTP	Yes
18-2	Submit the NEPP Risk Management Plan.	18.1.4	Within 30 days after NTP	Yes
18-3	Submit the Master Program Schedule in accordance with the requirements of the Contract.	18.1.5	Within 30 days after NTP	Yes
18-4	Submit a monthly progress report by the fifth day of each month that covers activities for the previous month.	18.1.6	5th day of every month	Yes
18-5	Prepare and distribute an agenda to all participants expected to attend the meetings seven days prior to the scheduled meeting date	18.1.10	7 days prior to scheduled Progress Review Meeting	Yes

CDRL No.	Description	Section	Due	Approval Required
18-6	Submit a Quality Assurance Program Plan. This Plan shall also include Reliability Assessment Program elements.	18.2.2	Within 60 days after NTP	Yes
18-7	Provide all procedures and processes for the creation of the software modules from the source code to the executables, and for the checking and verification of the versions of each of the software modules against the version of software deployed in the field on NEPP devices.	18.2.6	FDR	Yes
18-8	Provide documents, drawings, and data including all information conveyed for the design review meetings, as described within this Technical Specification section and their completed, final form and all other submittals described in this Contract.	18.3	CDR, PDR, FDR	Yes
18-9	Submit the project action item log on which all action items identified during the design reviews shall be recorded.	18.3	Within 30 days after NTP	
19-1	Submit the proposed NEPP Phased Deployment Plan.	19.1	Within 30 days of NTP	Yes
19-2	Submit the Installation and Interface Plan (IIP).	19.3.1	PDR, FDR	Yes
19-3	Submit a Site Specific Work Plan (SSWP) for each station, bus facility, parking garage, and every other locations where work shall be performed as part of this contract.	19.3.3	PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
19-4	Submit a Site Specific Safety Plan (SSSP) for each station, bus facility, parking garage, and every other locations where work shall be performed as part of this contract.	19.3.4	PDR, FDR	Yes
19-5	Submit all power requirements for the NEPP communications equipment.	19.3.7	Following NTP	Yes
19-6	Submit all power requirements for the NEPP field devices.	19.3.7	Following NTP	Yes
19-7	Submit documents and drawings detailing design and installation of NEPP equipment at each Metrorail Station.	19.3.8	CDR, PDR	Yes
19-8	Submit documents and drawings detailing design and installation of NEPP equipment at Bus Facilities.	19.3.9	CDR, PDR	Yes
19-9	Provide all mobile equipment installation plans and material lists	19.3.10	FDR	Yes
19-10	Submit all power requirements for all components of the CDS.	19.3.11	Within 45 days of NTP	Yes
19-11	Submit all power requirements for the NEPP Simulator Lab devices and submit the environment operating requirements for the Simulator Lab.	19.3.12	Within 45 days of NTP	Yes
19-12	Submit the comprehensive test program plan inclusive of 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.	19.4.2	PDR	Yes

CDRL No.	Description	Section	Due	Approval Required
19-13	Submit where required by WMATA, updated test procedures.	19.4.3	Within 15 days of test commencement	Yes
19-14	Submit the procedures to be followed for the resolution of test problems, failures, inaccuracies, and general test conduct ground rules of failure resolution.	19.4.3.1	Within 45 days of NTP	Yes
19-15	Identify the tests for which waivers may be requested at the Conceptual Design Review, including all information 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.	19.4.3.2	Following NTP	Yes
19-16	Submit the test plan for the CDS, network, and communication system, inclusive of all portions of the communications network, wired as well as wireless.	19.7	FDR	Yes
19-17	Submit the test plan for the FAT Functional Test.	19.8	FDR	Yes
19-18	Submit the test plan for the FAT Vibration Test.	19.8	FDR	Yes
19-19	Submit the test plan for the FAT Shock Test.	19.8	FDR	Yes
19-20	Submit the test plan for the FAT Electromagnetic Effects Test.	19.8	FDR	Yes
19-21	Submit the test plan for the FAT Radiation and Electromagnetic Interference Test.	19.8	FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
19-22	Submit the test plan for the FAT Temperature/Humidity/Voltage Test.	19.8	FDR	Yes
19-23	Submit the test plan for the FAT Water Intrusion Test.	19.8	FDR	Yes
19-24	Submit the test plan for the FAT Dust Test.	19.8	FDR	Yes
19-25	Submit the test plan for the First Article Enclosure Integrity.	19.8	FDR	Yes
19-26	Submit the test plan for the FAT Maintainability Test.	19.8	FDR	Yes
19-27	Submit the test plan for the FAT CDS Software Verification Test.	19.8	FDR	Yes
19-28	Submit the test plan for the FAT System Interface Test.	19.8	FDR	Yes
19-29	Submit the test plan for the FAT Application Verification Test.	19.8	FDR	Yes
19-30	Submit the test plan for the FAT Cycling Test.	19.8	FDR	Yes
19-31	Submit the test plan for the FAT Report Generation Test.	19.8	FDR	Yes
19-32	Submit the test plan for the PAT	19.9	FDR	Yes
19-33	Submit the test plan for the PIC	19.11	FDR	Yes
19-34	Submit the Integration Test plan to verify that all NEPP components are fully integrated to perform as a single system for WMATA and ensure that all NEPP equipment can successfully process the smart media issued and/or processed by the all other equipment procured under each contract.	19.13	PDR	Yes

CDRL No.	Description	Section	Due	Approval Required
19-35	Submit the Equipment Maintenance Report format and sample.	19.14.4	Following NTP	Yes
19-36	Submit a report providing the results of the Wireless Broadband POC inclusive of all information required to ensure that the NEPP devices in conjunction with the wireless broadband system demonstrates the ability to meet WMATA's requirements.	19.15	At the completion of the POC test	Yes
20-1	Electronic versions of all final drawings	20.1	Each Installation Phase	Yes
20-2	List of sensitive information to be included in manuals	20.2	FDR	Yes
20-3	Manual Outlines	20.3.1	CDR	Yes
20-4	Preliminary Draft Manuals	20.3.2	PDR	Yes
20-5	Final Manuals	20.3.3	45 Days Prior to Deployment	Yes
20-6	Final NEPP System Manuals	20.3.4	FAT for final deployment	Yes
20-7	Manual Revisions	20.3.5	As needed, through warranty period	Yes
20-8	Complete Bill of Material (BOM) for each piece of equipment	20.4.2.6	15 days prior to installation	No
20-9	Security Manual	20.4.4	FAT for final deployment	Yes
20-10	Recommended Consumable Parts List	20.5.1.2	FDR	No
20-11	Recommended Replacement Parts List	20.5.1.3	FDR	No
20-12	Recommended Repair Parts List	20.5.1.4	FDR	No

CDRL No.	Description	Section	Due	Approval Required
20-13	Recommended Overhaul Parts List	20.5.1.5	FDR	No
20-14	Spare Parts Inventory	20.5.1.6	30 days prior to installation	Yes
20-15	List of Component Sourcing	20.5.2	15 days prior to installation	No
20-16	Custom Tools List	20.5.3	CDR, FDR	No
20-17	MSD Hardware elements details	20.5.5.1	CDR, FDR	Yes
20-18	MSD Displayed Messages List	20.5.5.1.1.	CDR, FDR	Yes
20-19	MSD Software elements details	20.5.5.2	CDR, FDR	Yes
20-20	Simulator Lab Equipment	20.5.6	CDR, FDR	Yes
21-1	Video and audio recording of each training course	21.1	Completion of each deployment phase	No
21-2	Instructor Qualifications	21.2	PDR, FDR	Yes
21-3	Training Schedule	21.3	45 days after NTP	Yes
21-4	Training Program Plan	21.4	PDR, 90 days prior to deployment	Yes
21-5	Instructor Resumes	21.4.4	60 days prior to course	Yes
21-6	Course Curricula and Training Materials	21.5	PDR, FDR	Yes
21-7	Train the Trainer Laptops and Equipment	21.5	Prior to Train the Trainer Program	No
21-8	Training Materials	21.5	Completion of course	No
21-9	Student Training Materials – Hard Copy	21.6	Prior to course	No

CDRL No.	Description	Section	Due	Approval Required
21-10	Student Training Materials – Electronic Copies	21.6	Prior to course	No
21-11	Instructor Materials	21.6	Prior to course	No
21-12	Training Course Tests	21.7	Prior to course	Yes
22-1	Provide a full description of the plan for the transition of Customer Support Services and all associated hardware and software to WMATA control upon conclusion of the performance period	22	PDR, FDR	Yes
22-2	Provide a full description of the architecture to be deployed for the NEPP Customer Support System	22	CDR, PDR, FDR	Yes
22-3	Provide a complete description of the Auto Replenishment function	22.1.4	PDR, FDR	Yes
22-4	Provide a complete description of the Application Processing function	22.2.1	PDR, FDR	Yes
22-5	Provide a complete description of the design and functionality of all CSA web pages	22.2.3	PDR, FDR	Yes
22-6	Provide a complete description of the hardware and software deployed for the ACD and IVR systems.	22.2.4	PDR, FDR	Yes
22-7	Describe the plan for accommodating all NEPP CSCC traffic.	22.2.4	PDR, FDR	Yes
22-8	Provide drafts of all standard and ad-hoc reports produced from the CDS.	22.2.4.3	PDR, FDR	Yes
22-9	Provide a complete description of pay-by-space system Payment via Cell Phone functionality provided by the CDS.	22.2.9	CDR, PDR, FDR	Yes

CDRL No.	Description	Section	Due	Approval Required
22-10	Provide sample standard and ad-hoc reports for all Customer Support Services reports produced from the CDS.	22.6	PDR, FDR	Yes
23-1	Contractor Local Point-of-Contact information and schedule	23.1.1	Monthly	No
23-2	Maintenance Services Plan	23.2.4	PDR, FDR	Yes
23-3	System Maintenance Procedures	23.2.4	PDR, FDR	Yes
23-4	Revenue Services Plan	23.3.4	PDR, FDR	Yes
23-5	Benefits Program Management Plan	23.5	PDR, FDR	Yes
23-6	Management of Benefits Program Support Procedures	23.5	FDR	Yes
23-7	Smart Media Procurement Plan	23.6	PDR, FDR	Yes
23-8	Network Administration Plan	23.7	PDR, FDR	Yes
23-9	Network Administration Procedures	23.7	FDR	Yes
23-10	Bankcard Processing Services Plan	23.8	PDR, FDR	Yes
23-11	Bankcard Processing Services Procedures	23.8	FDR	Yes

End of Section 24

Exhibit 1 – Acronyms, Abbreviations and Definitions

ACRONYMS, ABBREVIATIONS AND DEFINITIONS

Acronyms and Abbreviations

3DES	Triple DES
ABA	American Bankers Association
AC	Alternating Current
ACH	Automated Clearing House
ADA	Americans with Disabilities Act
AES	Advanced Encryption Standard
AFC	Automatic Fare Collection
ANSI	American National Standards Institute
API	Application Programming Interface
ASTM	American Society for Testing and Materials
ASV	Approved Scanning Vendor
ATIS	Automated Transit Information System
BCPS	Bank Card Processing Server
BOM	Bill of Materials
CAC	Common Access Card
CCTV	Closed-Circuit Television
CDS	Central Data System
CDR	Conceptual Design Review
CDRL	Contract Data Requirements List
CM	Corrective Maintenance
CPOS	Customer Point of Sale
CPU	Central Processing Unit

CQC	Contractor's QA/QC Manager for the NEPP System Project
CSA	Customer Services Application
CSC	Customer Support Center
CSR	Customer Support Representative
CSS	Customer Support System
CTA	Computer Telephony Interface
CTF	Carmen Turner Facility
DES	Data Encryption Standard
DTE	Diagnostic Test Equipment
DUKPT	Derived Unique Key Per Transaction
DVD	Digital Versatile Disc
ECP	Engineering Change Proposal
EEPROM	Electrical Erasable Programmable Read Only Memory
EFT	Electronic Transfer of Funds
EIA	Electronic Industries Alliance
EMI	Electromagnetic Interference
EMV	Europay MasterCard Visa
EPROM	Erasable Programmable Read Only Memory
EU	European Union
FACI	First Article Configuration Inspection
FAT	First Article Test
FCC	Federal Communications Commission
FDR	Final Design Review
FIPS	Federal Information Processing Standards
FOCS	Fiber Optic Communication System

FODS	Fiber Optic Distribution Shelves
FOP	Fiber Optics Platform
FRB	Failure Review Board
FVD	Fare Vending Device
GB	Gigabyte(s)
GHz	Gigahertz (Frequency of One Billion Cycles per Second)
GP	Global Platform
GPS	Global Positioning System
GPR	General Purpose Reloadable
GUI	Graphical User Interface
HIPAA	Health Insurance Portability and Accountability Act
Hz	Hertz (Frequency of One Cycle per Second)
HVSD	Handheld Validation and Sales Device
IAT	Installation Acceptance test
IEEE	Institute of Electrical and Electronic Engineers
IIP	Installation and Interface Plan
IRS	Internal Revenue Service
ISO, ISO/IEC	International Standards Organization
IVR	Interactive Voice Response
KPI	Key Performance Indicator
LAN	Local Area Network
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LLRU	Lowest Level Replaceable Unit
LRV	Light Rail Vehicle
LTE	Long Term Evolution
MARC	Maryland Area Regional Commuter

MCBF	Mean Cycles Between Failure
MDT	Mobile Data Terminal
MIL-STD	Military Standard
MIMO	Multiple-Input Multiple-Output
MSD	Maintenance Support Device
MTA	Maryland Transit Administration
MTBF	Mean Time Between Failure
NCS	Nextfare 5 Central System
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NEPP	New Electronic Payments Program
NEPPCN	NEPP Communications Network
NEPPDS	NEPP Database Server
NEPPWC	NEPP Wireless Communication
NFC	Near Field Communications
NFPA	National Fire Protection Agency
NIST	National Institute of Standards and Technology
NTP	Notice to Proceed
NVRAM	Non-Volatile Random Access Memory
OBPT	On-Board Bus Payment Target
OCU	Operator Control Unit
ODBC	Open Data Base Connectivity
OCD	Operator Control and Display
OEM	Original Equipment Manufacturer
OFNP	Optical Fiber Non-Conductive Plenum
OSHA	Occupational Safety and Health Administration
OTDR	Optical Time-Domain Reflectometer

PASD	Portable Administrative Sales Device
PAT	Production Acceptance Test
PAYGO	Pay as You Go
PCB	Printed Circuit Boards
PCI-DSS	Payment Card Industry Data Security Standard
PA-DSS	Payment Application Data Security Standard
PCI-PTS	Payment Card Industry PIN Transaction Security
PCMCIA	Personal Computer Memory Card International Association
PDR	Preliminary Design Review
PCI	Pre-Installation Checkout
PIN	Personal Identification Number
PIV	Personal Identification Verification
PPT	Payment Processing Target
PROM	Programmable Read Only Memory
PRM	Progress Review Meeting
PRTC	Potomac and Rappahannock Transportation Commission
PSTN	Public Switched Telephone Network
PTE	Portable Test Equipment
PTU	Passenger Transaction Unit
PLP	Payment Lane Processor
POC	Proof of Concept
PV	Platform Validator
QA/QC	Quality Assurance/ Quality Control
QSA	Qualified Security Assessor
RAID	Redundant Array of Independent Disks
RDBM	Relational Database Manager

RF	Radio Frequency
RFI	Radio Frequency Interference
RFID	Radio Frequency Identification
RFP	Reduced Fare Program
SAE	Society of Automotive Engineers
SAN	Storage Area Network
SD	Sales Device
SL	Simulator Lab
SONET	Synchronous Optical Network
SQL	Structured Query Language
SSL	Secure Sockets Layer
SSWP	Site Specific Work Plan
T1	T1 Carrier System (1.544 Mbps)
T3	T3 Carrier System (44.736 Mbps)
TCP/IP	Transmission Control Protocol/Internet Protocol
TIA	Telecommunications Industry Association
TKIP	Temporal Key Integrity Protocol
USB	Universal Serial Bus
UL	Underwriters Laboratories, Inc.
UPS	Uninterruptible Power Supply
VAC	Volts Alternating Current
VDC	Volts Direct Current
VRE	Virginia Railway Express
WAN	Wide Area Network
WiMax	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Area Network
WMATA	Washington Metropolitan Area Transit Authority

WPA	Wi-Fi Protected Access

Definitions

Wherever the following terms are used within these Technical Specifications, the intent and meaning shall be interpreted as follows:

- Whenever in the Specifications the words "acceptable", "accepted", "approval", "approved", "authorized", "condemned", "considered-necessary", "deemed necessary", "designated", "determined", "directed", "disapproved", "established", "given", "indicated", "insufficient", "ordered", "permitted", "rejected", "required", "reserved", "satisfactory", "unacceptable", "unsatisfactory", or words of like import are used, it shall be understood as if such words were followed by the words " in writing to or by WMATA or its designated representative", unless otherwise specifically stated.

- Wherever the word "indicated" is used, it shall be understood to mean "as described in the Technical Specifications", "as shown on the Contract Plans", or "as required by the other Contract Documents."

- Wherever the words "provided" or "supplied" are used in reference to work to be performed by the Contractor, it shall be understood to mean "furnished and delivered completed".

ACCEPTANCE. Reviewed for conformity to Contract requirements and accepted, in writing, by WMATA.

ADA FAREGATE. A fare gate that that is designed to allow the passage of an ADA customer and when installed satisfies all Federal, State and local ADA requirements and regulations.

ADVANCED ENCRYPTION STANDARD. A block cipher adopted as an encryption standard by the U.S. government.ANSI/TIA/EIA-526-7. Standard for the measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.

ANNAPOLIS TRANSIT. Public transportation system providing bus operations within Annapolis and Anne Arundel County, MD, connecting with destinations in the Washington D.C and Baltimore region.

ANSI/TIA/EIA-526-14-A. Standard for Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.

ANSI/TIA/EIA-568-B. A set of telecommunications standards from the Telecommunications Industry Association. The standards address commercial building cabling for telecom products and services.

APPLICATION PROGRAMMING INTERFACE. A source code interface that a computer system or program library provides in order to support requests for services to be made of it by other computer programs, and/or to allow data to be exchanged.

APPROVAL OR APPROVED. WMATA's written acknowledgement of acceptance.

AUTHENTICATE. To verify (guarantee) the identity of a person or entity or the validity of an item of Smart Media or credit/debit media. To ensure that the individual or organization is really who it says it is.

AUTHENTICATION. The process of verifying the identity of a person or other entity or the validity of an item of Smart Media or credit/debit media.

AUTHORIZATION. 1.) The assignment of a privilege or privileges (e.g., access to a building or network) verifying that a known person or entity has the authority to perform a specific operation. Authorization is provided after authentication. 2.) approval of credit/debit media by a central authority (CDS or banking/industry clearinghouse).

AUTOLOAD. Automatic replenishment of Smart Media. This will occur by registering the Smart Media to a specific customer account within the CDS and linking a means of external electronic payment (credit/debit media) with the card for automatic replenishment of the Smart Media with a calendar period pass or stored value amount upon the account reaching a certain threshold for date or low value, or upon completion of a fixed calendar duration.

AUTO-REPLENISHMENT. See Autoload.

BAD NUMBER LIST. This list shall store all known Smart Media identification numbers which cannot be used in the NEPP System. These shall include those defined by WMATA and its Partners as well as Credit/Debit Media identification numbers.

BANK ISSUED CREDIT MEDIA. Media that is connected to an existing credit account through a financial establishment. This media type is issued by a certified U.S. financial institution to customers for electronic payment of goods and services. This type of Smart Media is comprised of both Contactless Credit Media and Magnetic Credit Media.

BANK ISSUED DEBIT MEDIA. Media that is connected to an existing checking/savings account through a financial establishment. Utilization of this type of media is generally associated with the need to enter a PIN for identification and verification purposes, but can often be used without a PIN (See Signature Debit). This type of Smart Media is comprised of both Contactless Debit Media and Magnetic Debit Media.

BILL ACCEPTOR. A module that authenticates U.S. currency notes inserted.

BILL ESCROW. A secure module that is a component of the "Bill System" which serves as a temporary storage area for U.S. currency notes that have been authenticated until the transaction is completed. Escrowed bills are returned when a transaction is canceled.

BILL STACKER. A module within the Bill System that facilitates the stacking of U.S. currency notes in the secure vault.

BILL VAULT. A uniquely serialized locked box that holds U.S. currency notes that have been accepted on completion of a transaction and stacked by the bill stacker.

CALENDAR PASS. A fare on CDS that provides access to designated portions of the WMATA transportation system for a specified calendar period.

CALIBRATION. Comparison of two instruments or measuring devices, one of which is of known accuracy traceable to national standards, to detect, correlate, report, or eliminate by adjustment any discrepancy in the accuracy of the instrument or measuring device being compared with the standard.

CARD ASSOCIATION. Card association refers to VISA, MasterCard. American Express, and/or Discover.

CASH TRANSACTION TIME. The time from completion of Smart Media selection to when all Smart Media are deposited in the ticket/coin return bin, the receipt is issued (if selected) and all change is returned (if applicable)

CASHLESS FVD. A Fare Vending Device which accepts only electronic fare payment and does not accept currency, coins or tokens for fare payment. This device issues all fares processed by the NEPP System.

CENTRAL DATA SYSTEM (CDS). The computer system that controls all processes, transactions and events related to fare vending and collection device operation, as well as communications to the devices and external/ internal system. The CDS also serves as the repository and processor for all data transferred from NEPP equipment. It monitors and controls the NEPP equipment and ensures proper performance of the system as identified herein. It also stores fare tables and other system and equipment parameters for data exchange and provides interfaces to other systems.

CERTIFICATION. The action of determining, verifying, and attesting, in writing, to the qualifications of personnel, materials, and/or equipment.

CHARGEBACK. The reversal of a prior outbound transfer of funds from a consumer's bank account, line of credit, or credit card, as initiated by a consumer's bank.

CHARM CITY CIRCULATOR. Bus operation consisting of travel routes and free shuttles within Baltimore City.

CHIP. Electronic component that performs logic, processing, and/or memory functions.

CLEARINGHOUSE. A financial services company that provides clearing and settlement services for financial transactions.

CLOSED-LOOP MANNER. Uses routing alternatives to branded payment networks, but relies on open standards technology and processes for acceptance of the Media and electronic transfers of funds.

CLOSED LOOP NEPP LONG-TERM SMART CARD MEDIA. A memory-based card and is intended for use and reload through the WMATA NEPP system and Preferred Vendor Sales locations only. A magnetic stripe is not required for this Smart Media. The media shall have a pre-encoded unique 16-digit unalterable serial number encoded on the embedded chip.

CLOSED LOOP OPEN STANDARD NEPP-ONLY MEDIA. Smart Media that does not use a Bank Identification Number (BIN) of a U.S. financial institution and is intended for use and reload through the WMATA NEPP system and Preferred Vendor Sales locations only. A magnetic stripe is not required for this Smart Media.

CLOSED-LOOP, OPEN STANDARD PRIVATE LABEL MEDIA. Smart Media which includes a Bank Identification Number (BIN) of a U.S. financial institution. The Smart Media shall have WMATA or WMATA approved branding and shall not include branding of the underlying financial industry technology other than that required for accessing an applicable reload network. This Smart Media also have a magnetic stripe for reloading purposes only.

COIN ACCEPTOR. The module is part of the "Coin System". The device verifies the validity of U.S. issued coins inserted.

COIN ESCROW. A Coin System module that serves as a temporary storage area for U.S. coins that have been accepted until the transaction is complete. Escrowed coins are returned to the customer when a transaction is canceled.

COIN VAULT. A locked box that, as part of the Coin System, securely stores collected coins.

COLOMBIA PIKE STREETCAR INITIATIVE. Initiative by Arlington and Fairfax Counties to accommodate growing population urban corridor of Columbia Pike.

COMMON ACCESS CARD. A Department of Defense issued smart card for use as standard identification for active-duty military personnel, reserve personnel, civilian employees, other non-DoD government employees, state employees of the National Guard, and eligible contractor personnel.

COMPONENT. Any device having distinct electrical or mechanical characteristics and having connection points to be connected to other components to form a sub-assembly.

COMPONENT TESTING. The rigorous testing regimen that all components of the NEPP system are subject to.

CONNECTOR. Bus system operated by Fairfax County, VA. This service provides service within Fairfax County, connecting with Metrorail and other Washington, D.C. destinations.

CONSUMABLES. These are parts of the NEPP system, excluding Smart Media, computer system toner, NEPP equipment receipt stock, which either:

- may be expected to require replacement under normal maintenance schedules:
- have an expected life of less than five (5) years; or
- require replacement after performing their function one time (such as fuses).

CONTACTLESS CREDIT MEDIA. Credit Media employing an ISO/IEC 14443 compliant microchip and an internal RF antenna for communicating with a reader that is located on a fare vending or collection device (such as the MasterCard PayPass® and the Visa PayWave®).

CONTACTLESS DEBIT MEDIA. Debit Media employing an ISO/IEC 14443 compliant microchip and an internal RF antenna for communicating with a reader that is located on a fare vending or collection device.

CONTACTLESS SMART MEDIA. See Smart Media.

CONTRACT DRAWINGS. Drawings provided as part of the Contract Documents.

CONTRACTOR. The Prime Contractor for this WMATA contract who shall be solely responsible for the development of all hardware and software, its installation, quality, proper functioning, and reliability of the system; the person or persons, proposer, partnership, corporation, or combination thereof, which has entered into this contract with WMATA to supply the system.

CONTRACTOR'S DRAWINGS. Items such as detail drawings, graphs, diagrams, and sketches that are prepared by the Contractor to detail its work.

CORRECTIVE MAINTENANCE (CM). Performing unscheduled repairs necessary to correct a machine malfunction. CM includes diagnostic testing, finger-tip repairs, component change out, and verification testing.

CUE. The City of Fairfax's system that provides bus service within the city.

CUSTOMER SUPPORT SYSTEM. Centralized customer support center providing walkup, Internet, and telephone support to WMATA's Open Payment customers. Responsible for handling all customer enquiries associated with smart media account activity as well as issuance and fulfillment of all smart media requests and management of customer accounts.

DASH. The Alexandria Transit Company's system that provides bus service within the City of Alexandria,

DATA ENCRYPTION STANDARD. A method for encrypting information. (See related term Triple (3) DES.)

DC CIRCULATOR. Bus operation consisting of six routes in Washington DC.

DC STREETCAR. See District of Columbia Street Car Initiative.

DEPLOYMENT PLAN. The methodology by which the Contractor will deploy the NEPP System as defined in Section 21 of this Technical Specification.

DIN RAIL. A top-hat rail that is a standardized 35 mm wide metal rail with a hat-shaped cross section. It is used for mounting circuit breakers and industrial control equipment inside equipment racks.

DISTRICT OF COLOMBIA STREETCAR INITIATIVE. A surface light rail/ street car system in Washington, D.C. The first two lines of the system, the Anacostia and Benning lines are currently under construction.

DOLLAR COIN. This includes the U.S. dollar coins issued beginning 1979 - Susan B. Anthony, Sacagawea, and Presidential U.S. dollar coins.

DORMANT CARD. WMATA Smart Media that has had no transaction activity for a WMATA-defined period of time and shall be suspended until reactivated by a WMATA agent. Attempts to use this Media shall be denied by the NEPP equipment.

DOWNLOADING. The process of transferring data from the Central Data Collection and Reporting System to the Station LANs and NEPP Equipment.

ELEMENTS. NEPP System Devices and Software.

ENCRYPTION. The process of translating information into a code that can only be read if the reader has access to the key that was used to encrypt it. There are two main types of encryption, asymmetric (or public key), and symmetric (or secret key).

EQUAL. The make or quality of material or equipment in this Contract, WMATA's decision as to whether any material or equipment proposed is equal to that specified shall be binding on both the Contractor and WMATA.

ESCROW DEPOSIT. Placement of source code, development tools, documentation, and all other software required to replicate the executable CDS and device software with an agreed with third party who will insure the safe keeping of these items and shall also release the items to WMATA under specific defined conditions.

EUROPAY MASTERCARD VISA (EMV). Specifications developed jointly by Europay, MasterCard, and Visa that define a set of requirements to ensure interoperability between payment chip cards and terminals.

EXACT FARE MODE. A degraded mode of operations where the FVD accepts coins and/or bills for payment but may have insufficient coins to make change.

EXIT FVD. A Fare Vending Device installed in the paid area of the rail station which accepts electronic fare payments, coins, currency and tokens for fare payment. The Exit FVD provides for the addition of value to an existing Transit Account as well as issuing a LUM for a WMATA-specified fare for use as a Smart Media which permits the Customer to exit the paid area.

FACIAL DIMENSION. Nominal tile size as defined in ANSI A137.1.

FAIL SAFE. A characteristic of a system, which insures that any malfunction affecting safety, shall cause the system to revert to a state that is known to be safe. To be considered "fail safe", the systems shall also automatically furnish an acceptable indication that a failure has occurred.

FAILURE. The inability of a system, subsystem, assembly, software or component to perform its required function. An improper condition requiring the equipment/software to be withheld from or removed from service for corrective action.

FAREGATE. An item of NEPP equipment installed at a station which provides a barrier and bars passage until it determines, by reading an item of Smart Media, that the user has paid a valid fare. One customer is allowed passage for each valid fare that is presented.

FARE VENDING DEVICE. Self-service customer operated device, which has the ability to sell all types of Smart Media offered by WMATA and update accounts stored on the CDS. There are multiple types of FVDs: Full Service FVDs, Exit FVDs, Cashless FVDs

FULL SERVICE FVD. A Fare Vending Device which accepts electronic fare payments, coins, currency and tokens. This device issues all fares processed by the NEPP System.

GENERAL PURPOSE RELOADABLE (GPR) SMART MEDIA. Media that uses open standard technology and processes for executing payment transactions in an account-based manner. Replenishment of the account is permitted. The Media is accepted for payment purposes at multiple merchants by both the Media's "branding" and compliance with processing rules of any one of the major card associations or brands (i.e., VISA, MasterCard, American Express, etc.) and the merchant's acceptance of those brands. The Media itself can be equipped with a dual-interface of magnetic stripe and a contactless chip to in order to permit a broader range of acceptance and reload opportunities.

HANDHELD VALIDATION AND SALES DEVICE. Device that communicates with the CDS to displays the validity of the Smart Media presented for transportation payment purposes. The primary intent of this device is for use by WMATA staff to verify validity of and sell fares, update accounts on the CDS, provide customer assistance, and communicate with selected station and parking equipment.

IDENTIFICATION CARD. Card identifying its holder and issuer, which may carry data required as input for the intended use of the card and for transactions based thereon.

IEEE 802.11. Set of standards for Wireless Local Area Network computer communication, in the 5 GHz and 2.4 GHz public spectrum bands.

IEEE 802.11N. An amendment to the IEEE 802.11 wireless networking standard. Increases the maximum raw (PHY) data rate from 54 Mbit/s to a maximum of 600 Mbit/s.

IEEE 802.16. Working Group on Broadband Wireless Access Standards, to prepare formal specifications for the global deployment of broadband Wireless Metropolitan Area Networks.

IEEE 802.16E. Standard for a mobile Broadband Wireless Access Standards.

IMPLEMENTATION PERIOD. Time period from WMATA approval of NEPP Final Design Review submittal through WMATA approval of NEPP after Contractor implementation of complete NEPP System functionality.

INTELLECTUAL PROPERTY. Information, systems, software, programs, processes, technology, services, methodologies, products, and any other materials or rights, tangible or intangible, all relating to the WMATA project.

INTERFACE. The points where two or more systems, subsystems, or structures meet, transfer energy, or transfer data or information.

INSPECTION. A phase of Quality Control, which by means of examination, observation, or measurement, determines the conformance of materials, components, parts, appurtenances, systems, processes, installations, or structures to predetermined quality requirements.

ISO/IEC 14443. The international standard, "Identification Cards - Contactless Integrated Circuit(s) Cards - Proximity Cards," for contactless smart chips and cards that operate (i.e., can be read from or written to) at a distance of less than 10 centimeters (4 inches). This standard operates at 13.56 MHz.

ISO/IEC 18092. The internal standard for short-range wireless standard that uses magnetic field induction to enable communication between devices when they are brought close together (within 10-20 centimeters or 4-8 inches). NFC technology is compatible with ISO/IEC 14443-based technology.

INVALID SMART MEDIA LIST. A list of unique Smart Media serial numbers, representing Smart Media, bank issued credit media, and bank issued debit media that have been determined to be invalid or unacceptable.

LICENSEE. Entity to whom a license is granted.

LICENSOR. Entity who owns the property for which the license is conveyed.

LINKED TRIP. The total number of riders and measures the actual number of complete trips from origin to destination, including transfers.

LOCAL AREA NETWORK. A data communication network conforming to IEEE standards, that is used to connect multiple computer controlled devices in close proximity to one another, i.e., in one office or building.

LOUDOUN COUNTY COMMUTER BUS SERVICE. A commuter bus service operated by the Loudoun County, VA. This service provides rush hour service from park and ride lots to Metrorail stations and other Washington, D.C. destinations.

MAGNETIC CREDIT MEDIA. Bank issued credit media that incorporates a magnetic stripe that is encoded per ABA standards.

MAGNETIC DEBIT MEDIA. Bank issued debit media that incorporates a magnetic stripe that is encoded per ABA standards.

MAINTAINABILITY. The ability of the NEPP System to be maintained by maintenance staff, including enhancement of access to equipment and components that require maintenance.

MAINTENANCE SUPPORT DEVICE (MSD). A portable piece of equipment used by the WMATA maintenance personnel that is linked to the CDS via the wireless data network and provides information to assist in maintenance of the NEPP equipment. This assistance includes interfaces with the work order system, spare parts and module tracking as well as storage and display of information from the Contractor-provided manuals and system documentation.

MARYLAND AREA RAIL COMMUTER. A regional rail operation, operated by the Maryland Transit Administration, that provides three lines of services from Maryland, all terminating at Washington Union Station.

MARYLAND TRANSIT ADMINISTRATION. A state-operated agency that provides public transportation in the Baltimore-Washington Metropolitan Region. Service includes local bus, Light Rail, Baltimore Metro Subway, MTA Maryland Commuter Bus, and MARC service.

MERCHANT ACQUIRER. The entity, usually a processor and an associated financial institution, that processes and settles a merchant's credit and debit transactions with card associations and issuers of credit and debit cards. In order to receive payment from those credit and debit accounts, merchants are required to establish and maintain a business relationship with a Merchant Acquirer as the intermediary between the various participants in the payment of funds from the customer's credit or debit account to the merchant.

METRO. See WMATA.

METROACCESS. WMATA's shared-ride, door-to-door, paratransit service for people whose disability prevents them from using bus or rail.

METROBUS. The bus system in operation by the Washington Metropolitan Area Transit Authority. This operation consist of 1,480 buses that sever over 300 bus routes and cover more than 1,500 square miles in Washington D.C., Virginia, and Maryland.

METRORAIL. The rapid transit system in operation by the Washington Metropolitan Area Transit Authority. This rail operation primarily services Washington, D.C. and connects to Montgomery and Prince George's counties in Maryland, and Fairfax and Arlington counties as well as the city of Alexandria in Virginia. This operation consists of 86 stations on five lines with 106.3 miles of track.

MODULE. A standardized, interchangeable unit, designed to facilitate maintenance, and repair.

MODULE SIZE. Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

MTA MARYLAND. See Maryland Transit Administration.

NEAR FIELD COMMUNICATION (NFC). See ISO/IEC 18092

NEW ELECTRONIC PAYMENTS PROGRAM (NEPP) SYSTEM DEVICES. Hardware utilized within the NEPP System shall include, but not be limited to, Handheld Validation and Sales Devices, Faregates, Turnstiles, On-Board Payment Targets, etc. See also NEPP System Equipment.

NEW ELECTRONIC PAYMENTS PROGRAM (NEPP) SYSTEM EQUIPMENT. See NEW ELECTRONIC PAYMENTS PROGRAM (NEPP) SYSTEM DEVICES

NEPP TEST LAB. The NEPP Test Lab (NEPP-TL) shall mimic and represent the entire deployed NEPP System. When a subsequent deployment Phase requires the implementation of a new function or set of functions into the accepted NEPP System or any accepted NEPP System element from a previous deployment phase, a comprehensive test of the feature and a regression test of its impact on the entire NEPP System shall be conducted in the NEPP Test Lab.

NFPA 130. Nation Fire Protection Association standard for fire protection requirements for underground, surface, and elevated fixed guideway transit and customer rail systems, including trainways, vehicles, and vehicle maintenance and storage areas, and for life safety from fire in fixed guideway transit and customer rail system stations, trainways, vehicles, and outdoor vehicle maintenance and storage areas. This shall include stations accommodating customers and employees of the fixed guideway transit and customer rail systems and incidental occupancies in the stations.

NOISE. Interference presented on a system by undesirable voltages or currents.

NON-PROPRIETARY HARDWARE. Hardware utilized within the NEPP System on which a Contractor does not purposely place compatibility restrictions, in order to maintain a Contractor lock to provide hardware.

NON-PROPRIETARY SOFTWARE. Software utilized within the NEPP System which the developer/producer has not set or included restrictions on the software use, private modification, copying, or republishing. Developers/producers of non-proprietary software may not enforce restrictions by technical means, such as by restricting source code access, or by legal means, such as through copyright and/or patents.

ON-BOARD PAYMENT TARGET (OBPT). The device installed on theVehicles which is used to process the Smart Media presented by Customers. The OBPT incorporates an integrated Operator Control and Display for control of the OBPT and for displaying information associated with transactions that occur on WMATA's existing Farebox.

OPEN ARCHITECTURE. A system architecture that allows adding, upgrading and swapping functionally equivalent components from multiple suppliers, without extensive development efforts for their integration. Software interfaces are through well-defined APIs. Hardware interfaces use standard or third party connectors available through multiple suppliers and no proprietary hardware or software implemented that would restrict such addition, upgrade or swapout.

OPEN PAYMENT. Methods of electronic fare payment controlled by third parties and permitted as a fare payment method in the NEPP System, such as with credit cards, debit cards, etc., with their associated support systems. These open payment methods are based on standards and defined practices of the banking, financial services and payments industry.

OPEN PAYMENT SMART MEDIA. Contactless Credit Media, Contactless Debit Media, GPR Smart Media, third-party, or related transportation media forms compliant with ISO/IEC-14443 such as mobile phone fare payments, microchip equipped key fobs, etc.

OPERATIONAL SPARES. Spare cash containers used during the revenue servicing process for fare vending and collection devices. These include bulk coin hoppers, coin magazines, coin vaults and bill vaults for the fare vending and collection.

OPERATOR CONTROL AND DISPLAY (OCD). An integral device of the OBPT which is used by the vehicle operator to sign-on to the On-Board Payment Target to provide a single point of control for the on-board NEPP equipment.

OVERPAYMENT. Surplus payment made for a selected fare when sufficient change may not be available, i.e. the fare vending device may be in Exact Fare Only mode.

PARTNER ISSUED SMART MEDIA. Contactless Smart Media issued by an authorized partner of WMATA that is linked to an account established within the CDS.

PASSWORD. A form of secret authentication data that is used to control access to a resource. The password is kept secret from those not allowed access, and those wishing to gain access are tested on whether or not they know the password and are granted or denied access accordingly. Typically referred to as "something you know" for single factor authentication.

PAYMENT PROCESSING TARGET (PPT). A component within the fare vending or collection device that is correctly and efficiently interacting with an ISO/IEC compliant Smart Media; the device that processes Smart Media when it is touched ("tagged") to the surface of the unit.

PCI-COMPLIANT. Adheres to applicable standards of the Payment Card Industry (PCI), including but not limited to Payment Card Industry Data Security Standard (PCI-DSS), Payment Application Data Security Standard (PA-DSS), and Payment Card Industry PIN Transaction Security (PCI-PTS).

PERIOD PASS. A fare that provides access to designated portions of the WMATA system for a specified time period.

PERSONAL IDENTIFICATION NUMBER (PIN). An alphanumeric security code number that is associated with an ID card that adds a second factor of authentication to the identity verification process. Can be used in conjunction with an ATM card to access the cardholder's account for payment of Media purchase; an alphanumeric security code that is used by a WMATA employee to gain access to fare vending and collection devices for operation, servicing and/or maintenance.

PERSONAL IDENTIFICATION VERIFICATION (PIV) CARD. An ISO/IEC-14443 compliant identification issued by federal agencies. This card utilizes Public Key Infrastructure (PKI) technology that complies with all Federal security policies, and is the accepted Global Business Standard for Internet Security.

POSITIVE LIST. This list shall store selected known Smart Media identification numbers which can be used in the NEPP System without further verification required. Such Smart Media numbers shall include those of WMATA Employees and Customers (for which auto-replenish services have been enabled and remain authorized) who continue to satisfy WMATA's eligibility requirements. These shall include those defined by WMATA and its partners.

POTOMAC AND RAPPAHANNOCK TRANSPORTATION COMMISSION. A multi-jurisdictional agency representing Prince William and Stafford Counties and the cities of Manassas, Manassas Park and Fredericksburg.

PREEXISTING WORK. Intellectual property that is completed and/or owned by the Contractor, and that may be provided to WMATA for the project.

PREVENTIVE MAINTENANCE (PM). Performing periodic, scheduled procedures that ensure the equipment meets equipment reliability and availability targets with a minimum of corrective maintenance.

PRODUCT DATA. Illustrations, standard schedules, performance charts, instructions, brochures, diagrams, instructions, warnings, and other information furnished by the Contractor to illustrate or explain the fabrication, assembly, installation, maintenance, or operation of materials, equipment, or some portion of the work.

PROJECT MANAGER. Project Manager means WMATA's authorized representative having the responsibility to oversee and manage the day to day activities of the NEPP System contract.

QUALITY ASSURANCE (QA). A program of planned and systematic actions that provide adequate confidence that all activities affecting quality have been accomplished in accordance with governing codes, standards, and contract requirements. QA oversight of activities affecting quality is accomplished through field and manufacturing facility surveillance, audits, or other documented measures conducted to verify that requirements have been met.

QUALITY CONTROL (QC). The act of examining, witnessing, inspecting, checking, and/or testing of in-process or completed work to determine conformity with specified requirements and documenting the results.

QUALITY ASSURANCE (QA) AUDIT. A documented activity performed by written procedure or checklist to verify that selected elements of the Quality Assurance/Quality Control Program have been developed, documented, and implemented in accordance with specified requirements.

RADIO FREQUENCY. Any frequency within the electromagnetic spectrum associated with radio wave propagation. Many wireless communications technologies are based on RF, including radio, television, mobile phones, wireless networks, and contactless payment cards and devices.

RADIO FREQUENCY IDENTIFICATION. Technology that is used to transmit information about objects wirelessly, using radio waves. RFID technology is composed of 2 main pieces: the device that contains the data and the reader that captures such data. The device has a silicon chip and an antenna and the reader also has an antenna. The device is activated when put within range of the reader. The term RFID has been most commonly associated with tags used in supply chain applications in the manufacturing and retail industries.

REDUNDANCY. The existence in a system of more than one means to accomplish a given function, for the purpose of increasing security or reliability.

RELIABILITY. The performance of a specified function without failure and within design parameters for the period of time or the number of cycles specified under actual service conditions.

REVENUE SERVICE PROVEN (ALSO "SERVICE PROVEN" OR "PROVEN"). The historical success of equipment/software operating for a stated minimum successful performance of scheduled revenue service under similar conditions elsewhere and in accordance with the reliability requirements.

RIDE ON. The Montgomery County, MD, system that provides bus service within the county and connects with Metrorail and other Washington D.C. destinations.

SAFETY. The condition in which persons are free from threat, danger, harm, or loss arising from improper design, manufacture, assembly, malfunction, or failure of the NEPP system or any of its components or elements.

SECURE SOCKETS LAYER. A protocol used to transmit information on the Internet in encrypted form. SSL also ensures that the transmitted information is only accessible by the server that was intended to receive the information.

SERVICE, (AS IN SERVICE USE). The operation of the NEPP System under normal conditions with customers.

SHOP DRAWINGS. Items, such as drawings, calculations, and catalog cuts, which are prepared by the Contractor to supplement or detail Contract Drawings or Specifications, or are prepared at Contractor's option to detail its work; or which the Contractor is required to submit to the Engineer for review, information, or record, including electrical schematics and wiring diagrams, fabrication, erection, layout, assembly, installation, tests, maintenance, and repair drawings.

SIGNATURE DEBIT. Like PIN debit cards, Signature Debit Cards withdraw funds directly from the customers' depository or checking account in order to settle the transaction. Bank Issued Debit Cards can often be used for both PIN Debit and Signature Debit transactions. Unlike PIN debit, Signature Debit transactions do not require entry of a Personal Identification Number (PIN) in order to execute a payment transaction. Customers often select "Credit" when prompted at a payment terminal when making a Signature Debit purchase.

SITE INSPECTION. Site Inspection consists of reviewing, monitoring, observing, and inspecting the work at the project site.

SMART MEDIA. Smart Media that is compliant with ISO/IEC 7816 and ISO/IEC14443, employs an embedded integrated circuit and an internal RF antenna for communication. The integrated circuit can be either a secure microcontroller or equivalent intelligence with internal memory or a memory chip alone. The media communicates to a reader, without physical contact, via radio frequency interface. With an embedded microcontroller, Smart Media may store large amounts of data, carry out their own on-card functions (e.g., encryption and mutual authentication) and interact intelligently with a Smart Media Processor. Contactless Smart Media is available in a variety of form factors, including cards, subscriber identification modules used in GSM mobile phones, and USB-based tokens. Contactless Smart Media is comprised of WMATA Smart Media, Partner Smart Media, Contactless Credit Media and Contactless Debit Media.

SOFTWARE. The media and documents that regulate and control the operation of computer and microprocessor based systems including data transmission by specifying computer programs, procedures, and rules. It includes compilers, library routines, source codes, report generation, manuals, and flow charts.

SOURCE INSPECTION. Source inspection consists of the review, monitoring, observation, and/or inspection, random or consistent, or at selected stages of manufacture or construction, of manufacturer or sub-manufacturer's personnel, material, equipment, processes, or tests.

STANDARD. Something set up and established by a recognized authority as a rule for the measure of quantity, weight, extent, value, quality, or other performance measure. This includes specifications produced by accredited associations, such as ANSI, ISO, SIA, ETSI, or NIST. In the United States, the use of standards is typically optional and multiple standards can be developed on the same subject. In some countries, the use of existing standards may be required by law and the development of multiple standards on the same subject may be restricted.

STORED VALUE. WMATA Smart Media with value on deposit with WMATA.

SUB-ASSEMBLY. Two or more components combined into a unit for convenience in assembling or servicing equipment.

SUBCONTRACTOR. An individual, partnership, corporation or joint venture to whom the Contractor sublets any part of the Contract.

SURVEILLANCE. Term used to describe a review performed for the purpose of verifying that applicable quality requirements are properly accomplished

SWEEP. The process whereby WMATA employees start at one end of a rail or bus vehicle and moves to the other end while verifying that all Customers on-board have Smart Media valid for their trip.

TEST CARDS. Smart Media issued by the NEPP devices when they are in the maintenance or test mode, a mode settable from the CDS as well as locally at the NEPP device, which are not valid for transportation on any WMATA service and when used on a NEPP device not in the maintenance mode will identify the Smart Media as test media. Separate transactional and summary information is maintained by the NEPP System for these test cards.

THEBUS. Bus system operated by Prince George's County, MD. This service provides service within Prince George's county, connecting with Metrorail and other Washington, D.C. destinations.

TIMEOUT. When a prescribed amount of time has elapsed, during which a specified action has not occurred.

TRANSACTION DATA. The data stored by any fare vending or collection device in the WMATA NEPP System due to processing a customer Smart Media sale or use, the advent an event and/or an alarm, the initiation of a function within the devices or the change in the status of a device, module, item of equipment or system.

TRIPLE DES (3DES). A block cipher formed from the Data Encryption Standard (DES) cipher by using it three times.

TURNSTILE. A new bi-direction access control device located at WMATA Metrorail stations that maintains access to and egress from the station by processing user presented Fare Media. One customer is allowed passage into the station for each valid item of Fare Media that is processed.

UNLINKED TRIPS. The boardings on an individual vehicle, totaled individually.

WIDE AREA NETWORK (WAN). A public or private data communication network connecting multiple computer controlled devices, or local area networks (LANs) not located in close proximity to each other.

WIRELESS LAN. A local area network that transmits over the air typically in the 2.4GHz or 5GHz unlicensed frequency band, and comply to an industry standard. It does not require line of sight between sender and receiver. Wireless base stations (access points) are wired to an Ethernet network and transmit a radio frequency over an area of several hundred feet through walls and other non-metal barriers. Roaming users can be handed off from one access point to another like a cellular phone system.

WMATA. Washington Metropolitan Area Transit Authority

WMATA SMART MEDIA. Open Standard, Contactless Smart Media issued by WMATA that is linked to an account established within the CDS. Acceptable forms of media would include items such as ISO/IEC-14443 Type A and B smart cards, limited use smart cards, key fobs, cell phones, etc.

WMATA SERVICE AREA. The physical space occupied by a WMATA operated vehicle at any point in time during current operations.

Exhibit 17 – System Interfaces and APIs

17 System Interfaces and APIs 17-1

17.1 WMATA DATA WAREHOUSE DATA STRUCTURE 17-1

17.2 USEFUL NEXTFARE 5 FACT AND DIMENION DATA 17-35

17 SYSTEM INTERFACES AND APIS

17.1 WMATA Data Warehouse Data Structure

WMATA consists of various Functional Areas, with each consisting of several Departments. A number of these Functional Areas and their associated Departments shall be required to interface with the NEPP to access Cubic Nextfare 5 Central System data to support their functionality.

The WMATA Data Warehouse stores summarized data imported from the NextFare 5 Central System. The NEPP CDS shall interface with the WMATA Data Warehouse to import WMATA-selected data obtained from the NextFare 5 Central System. The WMATA Data Warehouse includes data tables that provide WMATA end users with fact and dimension data for the purposes of reporting and reconciliation.

Table 17-1 provides the existing data structure for the WMATA Data Warehouse.

Table 17-1: WMATA Data Warehouse Data Structure

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Date Key
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Period key
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Fac id
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Fare instrument id
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Route number
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Control date
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Entry count
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Transfer count
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Cash ride count
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Entry amount
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Transfer amount
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Cash ride amount
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Load amount

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Incomplete ride cash
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Incomplete nonride cash
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Facility -> Bus Ridership & Revenue Totals
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Date Bus -> Bus Ridership & Revenue Totals
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Fare Instrument -> Bus Ridership & Revenue Totals
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Route Jd -> Bus Ridership & Revenue Totals
NCS Bus Ridership & Revenue	Bus Ridership & Revenue Totals	Timeperiod -> Bus Ridership & Revenue Totals
NCS Bus Ridership & Revenue	Date Bus	Key
NCS Bus Ridership & Revenue	Date Bus	Day
NCS Bus Ridership & Revenue	Date Bus	Year Month
NCS Bus Ridership & Revenue	Date Bus	Month
NCS Bus Ridership & Revenue	Date Bus	Quarter
NCS Bus Ridership & Revenue	Date Bus	Year
NCS Bus Ridership & Revenue	Date Bus	Day Of Week
NCS Bus Ridership & Revenue	Date Bus	Day Of Week Number
NCS Bus Ridership & Revenue	Date Bus	Day Type
NCS Bus Ridership & Revenue	Date Bus	Holiday
NCS Bus Ridership & Revenue	Date Bus	Week Num
NCS Bus Ridership & Revenue	Date Bus	Week Ending
NCS Bus Ridership & Revenue	Date Bus	Service Type
NCS Bus Ridership & Revenue	Date Bus	Day: Year
NCS Bus Ridership & Revenue	Date Bus	Day: Quarter
NCS Bus Ridership & Revenue	Date Bus	Day: Month
NCS Bus Ridership & Revenue	Date Bus	Day: Day
NCS Bus Ridership & Revenue	Facility	Fac id
NCS Bus Ridership & Revenue	Facility	Fac Description
NCS Bus Ridership & Revenue	Fare Instrument	Fare Instrument Id
NCS Bus Ridership & Revenue	Fare Instrument	Fare Instrument Description
NCS Bus Ridership & Revenue	Fare Instrument	Rider Class Description
NCS Bus Ridership & Revenue	Fare Instrument	Fare Instrument Type Description
NCS Bus Ridership & Revenue	Fare Instrument	Ticket Type Description
NCS Bus Ridership & Revenue	Fare Instrument	Monetary Inst Type Description
NCS Bus Ridership & Revenue	Fare Instrument	Rider Class
NCS Bus Ridership & Revenue	Fare Instrument	Fare Instrument Type Id
NCS Bus Ridership & Revenue	Fare Instrument	Ticket Type Id
NCS Bus Ridership & Revenue	Fare Instrument	Monetary Inst Type Id
NCS Bus Ridership & Revenue	Route	Route Number
NCS Bus Ridership & Revenue	Route	Route Alpha

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Bus Ridership & Revenue	Route	Line Id
NCS Bus Ridership & Revenue	Route	Line Description
NCS Bus Ridership & Revenue	Route	Service Type
NCS Bus Ridership & Revenue	Route	Bpln Sector
NCS Bus Ridership & Revenue	Route	Jurisdiction
NCS Bus Ridership & Revenue	Route	Default Div
NCS Bus Ridership & Revenue	Route	Bpln Sector Descriptionr
NCS Bus Ridership & Revenue	Route	Service Plan Descriptionr
NCS Bus Ridership & Revenue	Route	Allocation
NCS Bus Ridership & Revenue	Route	Route Class
NCS Bus Ridership & Revenue	Route	Service Sector Seq
NCS Bus Ridership & Revenue	Route	Status
NCS Bus Ridership & Revenue	Route	Comments
NCS Bus Ridership & Revenue	Time Period	Period Key
NCS Bus Ridership & Revenue	Time Period	Period Description
NCS Bus Ridership & Revenue	Time Period	Time Range
NCS Bus Ridership & Revenue	Time Period	Begin Time
NCS Bus Ridership & Revenue	Time Period	End Time
NCS Daily Total	Block 1	Block Id
NCS Daily Total	Block 1	Route Id
NCS Daily Total	Block 1	Block Name
NCS Daily Total	Block 1	Reftime
NCS Daily Total	Block 1	Start Time
NCS Daily Total	Block 1	Nonschedule
NCS Daily Total	Block 1	Nonscheduleactive
NCS Daily Total	Block 1	Incident Log Id
NCS Daily Total	Block 1	Status
NCS Daily Total	Block 1	Run Id
NCS Daily Total	Block 1	Garage Id
NCS Daily Total	Block 1	Simulated
NCS Daily Total	Block 1	Sim Vehicle Id
NCS Daily Total	Block 1	Sim Operator Id
NCS Daily Total	Block 1	Block Alpha
NCS Daily Total	Block 1	Block Alpha Sort
NCS Daily Total	Block 1	Pref Bus Series 1
NCS Daily Total	Block 1	Pref Bus Series 2
NCS Daily Total	Block 1	Pref Bus Series 3
NCS Daily Total	Block 1	Yard Assignment Log Id
NCS Daily Total	Block 1	Marked For Deletion
NCS Daily Total	D Date Uft	Entdateint
NCS Daily Total	D Date Uft	Transit Date
NCS Daily Total	D Date Uft	YearMonth
NCS Daily Total	D Date Uft	Date Month
NCS Daily Total	D Date Uft	Date Quarter
NCS Daily Total	D Date Uft	Date Year

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Daily Total	D Date Uft	Day of Week
NCS Daily Total	D Date Uft	Day of Week Num
NCS Daily Total	D Date Uft	Day Type
NCS Daily Total	D Date Uft	Holiday Flag
NCS Daily Total	D Date Uft	Week Num
NCS Daily Total	D Date Uft	Date Week End
NCS Daily Total	D Date Uft	Service Type
NCS Daily Total	D Date Uft	Adjust Day
NCS Daily Total	D Date Uft	Device Service Type
NCS Daily Total	D Route	Route Number
NCS Daily Total	D Route	Route Alpha
NCS Daily Total	D Route	Line Id
NCS Daily Total	D Route	Route Name
NCS Daily Total	D Route Jd	Route Number
NCS Daily Total	D Route Jd	Route Alpha
NCS Daily Total	D Route Jd	Line Id
NCS Daily Total	D Route Jd	Line Description
NCS Daily Total	D Route Jd	Service Type
NCS Daily Total	D Route Jd	Bpln Sector
NCS Daily Total	D Route Jd	Default Jurisd
NCS Daily Total	D Route Jd	Default Div
NCS Daily Total	D Route Jd	Bpln Sector Descriptionr
NCS Daily Total	D Route Jd	Service Plan Id
NCS Daily Total	D Route Jd	Service Plan Descriptionr
NCS Daily Total	D Route Jd	Allocation
NCS Daily Total	D Route Jd	Route Class
NCS Daily Total	D Time Uft	Enttimeint
NCS Daily Total	D Time Uft	Enthourinterval
NCS Daily Total	D Time Uft	Enthalfhourofday
NCS Daily Total	D Time Uft	Enthourofday
NCS Daily Total	D Time Uft	Entampm
NCS Daily Total	D Time Uft	Enthourint
NCS Daily Total	D Time Uft	Entminutemin
NCS Daily Total	D Time Uft	Entminutemax
NCS Daily Total	D Time Uft	Entperiod
NCS Daily Total	D Time Uft	Ampeak
NCS Daily Total	D Time Uft	Entpeakflag
NCS Daily Total	D Time Uft	Halfhour24
NCS Daily Total	D Time Uft	Periodkey
NCS Daily Total	D Timeperiod	Periodkey
NCS Daily Total	D Timeperiod	Am Pm
NCS Daily Total	D Timeperiod	Time Period
NCS Daily Total	D Timeperiod	AmPM PeakNonpeak
NCS Daily Total	D Timeperiod	Peak Flag
NCS Daily Total	D mezzanine	Mezz id

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Daily Total	D mezzanine	Mezz name
NCS Daily Total	D mezzanine	Station
NCS Daily Total	D mezzanine	Zone
NCS Daily Total	D mezzanine	Segment
NCS Daily Total	D mezzanine	Line
NCS Daily Total	D mezzanine	Locale
NCS Daily Total	D mezzanine	Jurisdiction
NCS Daily Total	D mezzanine	Blue
NCS Daily Total	D mezzanine	Green
NCS Daily Total	D mezzanine	Orange
NCS Daily Total	D mezzanine	Red
NCS Daily Total	D mezzanine	Yellow
NCS Daily Total	D mezzanine	Facid
NCS Daily Total	Fare instrument	Fare instrument id
NCS Daily Total	Fare instrument	Operator id
NCS Daily Total	Fare instrument	Fare instrument Description
NCS Daily Total	Fare instrument	Descriptionription
NCS Daily Total	Fare instrument	Media type id
NCS Daily Total	Fare instrument	Rider class
NCS Daily Total	Fare instrument	Fare instrument type id
NCS Daily Total	Fare instrument	Ticket type id
NCS Daily Total	Fare instrument	Monetary inst type id
NCS Daily Total	Fare instrument	Calendar pass id
NCS Daily Total	Fare instrument	Count sale as ride flag
NCS Daily Total	Fare instrument	Ride limit daily flag
NCS Daily Total	Fare instrument	Ride limit
NCS Daily Total	Fare instrument	Trip validity time
NCS Daily Total	Fare instrument	Max transfers
NCS Daily Total	Fare instrument	Instrument display index
NCS Daily Total	Fare instrument	Validity period
NCS Daily Total	Fare instrument	Use print display index
NCS Daily Total	Fare instrument	Issue print display index
NCS Daily Total	Fare instrument	Autoload low value threshold
NCS Daily Total	Fare instrument	Autoload pass threshold
NCS Daily Total	Fare instrument	Autoload ride threshold
NCS Daily Total	Fare instrument	Num zones
NCS Daily Total	Fare instrument	Refund timeout
NCS Daily Total	Fare instrument	Autoload control id
NCS Daily Total	Fare instrument	Directed autoload bonus flag
NCS Daily Total	Fare instrument	Threshold autoload bonus flag
NCS Daily Total	Fare instrument	Recurring autoload bonus flag
NCS Daily Total	Fare instrument	Geography validity
NCS Daily Total	Fare instrument	Geography type
NCS Daily Total	Fare instrument	Geography validation
NCS Daily Total	Fare instrument	Updated

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Daily Total	Fare instrument	Version
NCS Daily Total	Fare instrument	Purchase amount
NCS Daily Total	Fare instrument	Purchase control id
NCS Daily Total	Media Type	Media Type Id
NCS Daily Total	Media Type	Type Of Media
NCS Daily Total	Media Type	Media Type Long Descriptionription
NCS Daily Total	Media Type	Media Type Description
NCS Daily Total	Operator	Operator Id
NCS Daily Total	Operator	Operator Long Descriptionription
NCS Daily Total	Operator	Operator Description
NCS Daily Total	Operator	Agency Id
NCS Daily Total	Operator	Operator Display Index
NCS Daily Total	Product Use Load	Product Use Load Id
NCS Daily Total	Product Use Load	Descriptionription
NCS Daily Total	Product Use Load	Product Use Load Description
NCS Daily Total	Product Use Load	Simple Description
NCS Daily Total	Product Use Load	Used By Linked Trips
NCS Daily Total	Sale Trans Summary	Control Date
NCS Daily Total	Sale Trans Summary	Agency Id
NCS Daily Total	Sale Trans Summary	Operator Id
NCS Daily Total	Sale Trans Summary	Date Key
NCS Daily Total	Sale Trans Summary	Facid
NCS Daily Total	Sale Trans Summary	Sale Transaction Type
NCS Daily Total	Sale Trans Summary	Fare Instrument Id
NCS Daily Total	Sale Trans Summary	Device Id
NCS Daily Total	Sale Trans Summary	Transaction Status Cd
NCS Daily Total	Sale Trans Summary	Periodkey
NCS Daily Total	Sale Trans Summary	Cash Flag
NCS Daily Total	Sale Trans Summary	Credit Flag
NCS Daily Total	Sale Trans Summary	Stored Value Flag
NCS Daily Total	Sale Trans Summary	Debit Flag
NCS Daily Total	Sale Trans Summary	Mag Fc Flag
NCS Daily Total	Sale Trans Summary	Smartbenefits Flag
NCS Daily Total	Sale Trans Summary	Auto Load Flag
NCS Daily Total	Sale Trans Summary	Count Tot
NCS Daily Total	Sale Trans Summary	Sv Transaction Tot
NCS Daily Total	Sale Trans Summary	Cash Collected Tot
NCS Daily Total	Sale Trans Summary	Cr Db Amount Tot
NCS Daily Total	Sale Trans Summary	Sv Amount Used Tot
NCS Daily Total	Sale Trans Summary	Deposit Tot
NCS Daily Total	Sale Trans Summary	Net Value Tot
NCS Daily Total	Sale Trans Summary	D Date Uft -> Sale Trans Summary
NCS Daily Total	Sale Trans Summary	Fare instrument -> Sale Trans Summary
NCS Daily Total	Sale Trans Summary	Operator -> Sale Trans Summary

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Daily Total	Sale Trans Summary	Sale Transaction Type -> Sale Trans Summary
NCS Daily Total	Sale Trans Summary	Transaction Status -> Sale Trans Summary
NCS Daily Total	Sale Trans Summary	Transit Facility 1 -> Sale Trans Summary
NCS Daily Total	Sale Trans Summary	D Timeperiod -> Sale Trans Summary
NCS Daily Total	Sale Trans Summary	fare instrument rider class -> Sale Trans Summary
NCS Daily Total	Sale Trans Summary Bus	Control Date
NCS Daily Total	Sale Trans Summary Bus	Agency Id
NCS Daily Total	Sale Trans Summary Bus	Operator Id
NCS Daily Total	Sale Trans Summary Bus	Date Key
NCS Daily Total	Sale Trans Summary Bus	Facid
NCS Daily Total	Sale Trans Summary Bus	Sale Transaction Type
NCS Daily Total	Sale Trans Summary Bus	Fare Instrument Id
NCS Daily Total	Sale Trans Summary Bus	Device Id
NCS Daily Total	Sale Trans Summary Bus	Route Number
NCS Daily Total	Sale Trans Summary Bus	Blcok Nbr
NCS Daily Total	Sale Trans Summary Bus	Transaction Status Cd
NCS Daily Total	Sale Trans Summary Bus	Cash Flag
NCS Daily Total	Sale Trans Summary Bus	Credit Flag
NCS Daily Total	Sale Trans Summary Bus	Stored Value Flag
NCS Daily Total	Sale Trans Summary Bus	Debit Flag
NCS Daily Total	Sale Trans Summary Bus	Mag Fc Flag
NCS Daily Total	Sale Trans Summary Bus	Smartbenefits Flag
NCS Daily Total	Sale Trans Summary Bus	Auto Load Flag
NCS Daily Total	Sale Trans Summary Bus	Count Total
NCS Daily Total	Sale Trans Summary Bus	Sv Transaction Tot
NCS Daily Total	Sale Trans Summary Bus	Cash Collected Tot
NCS Daily Total	Sale Trans Summary Bus	Cr Db Amount Tot
NCS Daily Total	Sale Trans Summary Bus	Sv Amount Used Tot
NCS Daily Total	Sale Trans Summary Bus	Deposit Tot
NCS Daily Total	Sale Trans Summary Bus	Net Value Tot
NCS Daily Total	Sale Trans Summary Bus	Block 1 -> Sale Trans Summary Bus
NCS Daily Total	Sale Trans Summary Bus	D Route -> Sale Trans Summary Bus
NCS Daily Total	Sale Trans Summary Bus	D Date Uft -> Sale Trans Summary Bus
NCS Daily Total	Sale Trans Summary Bus	Operator -> Sale Trans Summary Bus
NCS Daily Total	Sale Trans Summary Bus	Transit Facility 1 -> Sale Trans Summary Bus
NCS Daily Total	Sale Trans Summary Bus	Transaction Status -> Sale Trans Summary Bus
NCS Daily Total	Sale Trans Summary Bus	Sale Transaction Type -> Sale Trans Summary Bus

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Daily Total	Sale Trans Summary Bus	Fare instrument -> Sale Trans Summary Bus
NCS Daily Total	Sale Trans Summary Bus	fare instrument rider class -> Sale Trans Summary Bus
NCS Daily Total	Sale Transaction Type	Sale Transaction Type
NCS Daily Total	Sale Transaction Type	Descriptionription
NCS Daily Total	Sale Transaction Type	Sale Trans Type Description
NCS Daily Total	Sale Transaction Type	Simple Description
NCS Daily Total	Transaction Status	Transaction Status Cd
NCS Daily Total	Transaction Status	Descriptionription
NCS Daily Total	Transaction Status	Trans Status Description
NCS Daily Total	Transaction Status	Used By Clearing
NCS Daily Total	Transaction Status	Used By Sales Counts
NCS Daily Total	Transaction Status	Used By Sales Values
NCS Daily Total	Transaction Status	Include In Eod Sale Txn Proc
NCS Daily Total	Transaction Status	Include In Eod Use Txn Proc
NCS Daily Total	Transaction Status	Used By Linked Trips
NCS Daily Total	Transaction Status	Card In Use Flag
NCS Daily Total	Transit Facility 1	Facid
NCS Daily Total	Transit Facility 1	Agency Id
NCS Daily Total	Transit Facility 1	Transit Facility Type Id
NCS Daily Total	Transit Facility 1	Facility Description
NCS Daily Total	Transit Facility 1	Descriptionription
NCS Daily Total	Transit Facility 1	Road Type
NCS Daily Total	Transit Facility 1	Road Number
NCS Daily Total	Transit Facility 1	Road Prefix
NCS Daily Total	Transit Facility 1	Road Name
NCS Daily Total	Transit Facility 1	Road Suffix
NCS Daily Total	Transit Facility 1	City
NCS Daily Total	Transit Facility 1	Community
NCS Daily Total	Transit Facility 1	County
NCS Daily Total	Transit Facility 1	Province
NCS Daily Total	Transit Facility 1	State
NCS Daily Total	Transit Facility 1	Postal Code
NCS Daily Total	Transit Facility 1	Country
NCS Daily Total	Transit Facility 1	Operator Id
NCS Daily Total	Transit Facility 1	Authority Id
NCS Daily Total	Transit Facility 1	Contact Name
NCS Daily Total	Transit Facility 1	Contact Phone Number
NCS Daily Total	Transit Modes	Transit Mode Id
NCS Daily Total	Transit Modes	Descriptionription
NCS Daily Total	Transit Modes	Transit Mode Description
NCS Daily Total	Use Trans Summary	W Control Date
NCS Daily Total	Use Trans Summary	Agency Id
NCS Daily Total	Use Trans Summary	Operator Id

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Daily Total	Use Trans Summary	Date Key
NCS Daily Total	Use Trans Summary	Periodkey
NCS Daily Total	Use Trans Summary	Facid
NCS Daily Total	Use Trans Summary	Transit Mode Id
NCS Daily Total	Use Trans Summary	Use Type
NCS Daily Total	Use Trans Summary	Use Transaction Type
NCS Daily Total	Use Trans Summary	Device Id
NCS Daily Total	Use Trans Summary	Product Use Load Id
NCS Daily Total	Use Trans Summary	Fare Instrument Id
NCS Daily Total	Use Trans Summary	Media Type Id
NCS Daily Total	Use Trans Summary	Transaction Status Cd
NCS Daily Total	Use Trans Summary	Count Total
NCS Daily Total	Use Trans Summary	Amount Total
NCS Daily Total	Use Trans Summary	Fare instrument -> Use Trans Summary
NCS Daily Total	Use Trans Summary	D Date Uft -> Use Trans Summary
NCS Daily Total	Use Trans Summary	Media Type -> Use Trans Summary
NCS Daily Total	Use Trans Summary	Operator -> Use Trans Summary
NCS Daily Total	Use Trans Summary	Product Use Load -> Use Trans Summary
NCS Daily Total	Use Trans Summary	Transaction Status -> Use Trans Summary
NCS Daily Total	Use Trans Summary	Transit Facility 1 -> Use Trans Summary
NCS Daily Total	Use Trans Summary	Transit Modes -> Use Trans Summary
NCS Daily Total	Use Trans Summary	Use Transaction Type -> Use Trans Summary
NCS Daily Total	Use Trans Summary	Use Type -> Use Trans Summary
NCS Daily Total	Use Trans Summary	D Timeperiod -> Use Trans Summary
NCS Daily Total	Use Trans Summary	fare instrument rider class -> Use Trans Summary
NCS Daily Total	Use Trans Summary	D mezzanine -> Use Trans Summary
NCS Daily Total	Use Trans Summary Bus	Control Date
NCS Daily Total	Use Trans Summary Bus	Agency Id
NCS Daily Total	Use Trans Summary Bus	Operator Id
NCS Daily Total	Use Trans Summary Bus	Date Key
NCS Daily Total	Use Trans Summary Bus	Facid
NCS Daily Total	Use Trans Summary Bus	Transit Mode Id
NCS Daily Total	Use Trans Summary Bus	Use Type
NCS Daily Total	Use Trans Summary Bus	Use Transaction Type
NCS Daily Total	Use Trans Summary Bus	Device Id
NCS Daily Total	Use Trans Summary Bus	Product Use Load Id
NCS Daily Total	Use Trans Summary Bus	Fare Instrument Id
NCS Daily Total	Use Trans Summary Bus	Media Type Id
NCS Daily Total	Use Trans Summary Bus	Route Number

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Daily Total	Use Trans Summary Bus	Blcok Nbr
NCS Daily Total	Use Trans Summary Bus	Transaction Status Cd
NCS Daily Total	Use Trans Summary Bus	Count Total
NCS Daily Total	Use Trans Summary Bus	Sv Transaction Tot
NCS Daily Total	Use Trans Summary Bus	Block 1 -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	D Route -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	D Date Uft -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	Operator -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	Transit Facility 1 -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	Transit Modes -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	Use Type -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	Use Transaction Type -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	Transaction Status -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	Product Use Load -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	Fare instrument -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	Media Type -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	fare instrument rider class -> Use Trans Summary Bus
NCS Daily Total	Use Trans Summary Bus	D Route Jd -> Use Trans Summary Bus
NCS Daily Total	Use Transaction Type	Use Transaction Type
NCS Daily Total	Use Transaction Type	Descriptionription
NCS Daily Total	Use Transaction Type	Use Tran Type Description
NCS Daily Total	Use Type	Use Type
NCS Daily Total	Use Type	Descriptionription
NCS Daily Total	Use Type	Use Type Description
NCS Daily Total	Use Type	Affects Sv Liability
NCS Daily Total	Use Type	Count As Entry
NCS Daily Total	Use Type	Count As Exit
NCS Daily Total	Use Type	Free Entry Or Exit
NCS Daily Total	fare instrument rider class	Fare instrument id
NCS Daily Total	fare instrument rider class	Fare instrument Description
NCS Daily Total	fare instrument rider class	Rider class Description
NCS Daily Total	fare instrument rider class	Fare instrument type Description
NCS Daily Total	fare instrument rider class	Ticket type Description
NCS Daily Total	fare instrument rider class	Monetary inst type Description
NCS Daily Total	fare instrument rider class	Rider class
NCS Daily Total	fare instrument rider class	Fare instrument type id

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Daily Total	fare instrument rider class	Ticket type id
NCS Daily Total	fare instrument rider class	Monetary inst type id
NCS Parking	D Abuse	Misuseid
NCS Parking	D Abuse	Misuse
NCS Parking	D Free Card	Freecard Id
NCS Parking	D Free Card	Freecard
NCS Parking	D Nonmetro Rider	Nonmetrorider Id
NCS Parking	D Nonmetro Rider	Nonmetrorider
NCS Parking	NCS Rider Class	Class
NCS Parking	NCS Rider Class	Class Description
NCS Parking	NCS Canceled Freecard	Serial Num
NCS Parking	NCS Canceled Freecard	Mfg Serial Num
NCS Parking	NCS Category	Code
NCS Parking	NCS Category	Category_Description
NCS Parking	NCS D Attributes	Attributes Key
NCS Parking	NCS D Attributes	Negativeparking Id
NCS Parking	NCS D Attributes	Freecard Id
NCS Parking	NCS D Attributes	Nonmetrorider Id
NCS Parking	NCS D Attributes	Abuse Id
NCS Parking	NCS D Attributes	Negativeparking
NCS Parking	NCS D Attributes	Freecard
NCS Parking	NCS D Attributes	Nonmetrorider
NCS Parking	NCS D Attributes	Abuse
NCS Parking	NCS D Negative Parking	Negativeparking Id
NCS Parking	NCS D Negative Parking	Negativeparking
NCS Parking	NCS Device	Mezz
NCS Parking	NCS Device	Device
NCS Parking	NCS Device	Device Description
NCS Parking	NCS Free Card Region	Serial Num
NCS Parking	NCS Free Card Region	Rec Type
NCS Parking	NCS Free Card Region	Mezz Region
NCS Parking	NCS Free Card Region	Free Cards 1 -> Free Card Region 1
NCS Parking	NCS Free Cards	Mfg Serial Num
NCS Parking	NCS Free Cards	Serial Num
NCS Parking	NCS Free Cards	Last Name
NCS Parking	NCS Free Cards	First Name
NCS Parking	NCS Free Cards	Middle Name
NCS Parking	NCS Free Cards	Organization Code
NCS Parking	NCS Free Cards	Category Code
NCS Parking	NCS Free Cards	Status
NCS Parking	NCS Free Cards	Reason
NCS Parking	NCS Free Cards	Date Status Update
NCS Parking	NCS Organization	Code
NCS Parking	NCS Organization	Description
NCS Parking	NCS Parking Date	Date Key

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Parking	NCS Parking Date	Day
NCS Parking	NCS Parking Date	Year
NCS Parking	NCS Parking Date	Year Month
NCS Parking	NCS Parking Date	Month
NCS Parking	NCS Parking Date	Quarter
NCS Parking	NCS Parking Date	Day Of Week
NCS Parking	NCS Parking Date	Day Of Week Num
NCS Parking	NCS Parking Date	Day Type
NCS Parking	NCS Parking Date	Holiday
NCS Parking	NCS Parking Date	Week Num
NCS Parking	NCS Parking Date	Week
NCS Parking	NCS Parking Date	Service Type
NCS Parking	NCS Parking Facility	Mezz Id
NCS Parking	NCS Parking Facility	Mezz Name
NCS Parking	NCS Parking Facility	Station
NCS Parking	NCS Parking Facility	Line
NCS Parking	NCS Parking Facility	Locale
NCS Parking	NCS Parking Facility	Jurisdiction
NCS Parking	NCS Parking Facility	Facid
NCS Parking	NCS Parking Facility	Rider Fee
NCS Parking	NCS Parking Facility	Non-Rider Fee
NCS Parking	NCS Parking Facility	Pay Mode
NCS Parking	NCS Parking Summary	Year Month
NCS Parking	NCS Parking Summary	Attributes Key
NCS Parking	NCS Parking Summary	Rider Class
NCS Parking	NCS Parking Summary	Category Code
NCS Parking	NCS Parking Summary	Mezz Id
NCS Parking	NCS Parking Summary	Period Key
NCS Parking	NCS Parking Summary	Date Key
NCS Parking	NCS Parking Summary	Use Type
NCS Parking	NCS Parking Summary	Transaction Status Cd
NCS Parking	NCS Parking Summary	Control Date
NCS Parking	NCS Parking Summary	Trans Count
NCS Parking	NCS Parking Summary	Sv Transaction
NCS Parking	NCS Parking Summary	amount If Charged
NCS Parking	NCS Parking Summary	NCS Parking Date -> NCS Parking Summary
NCS Parking	NCS Parking Summary	NCS Parking Facility -> NCS Parking Summary
NCS Parking	NCS Parking Summary	NCS Parking Time Period -> NCS Parking Summary
NCS Parking	NCS Parking Summary	NCS Rider Class -> NCS Parking Summary
NCS Parking	NCS Parking Summary	NCS Category -> NCS Parking Summary

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Parking	NCS Parking Summary	NCS D Attributes -> NCS Parking Summary
NCS Parking	NCS Parking Time Period	Period Key
NCS Parking	NCS Parking Time Period	Period Description
NCS Parking	NCS Parking Time Period	Time Range
NCS Parking	NCS Parking Time Period	Begin Time
NCS Parking	NCS Parking Time Period	End Time
NCS Parking	NCS Parking Tran History	Transaction Dtm
NCS Parking	NCS Parking Tran History	Device Id
NCS Parking	NCS Parking Tran History	Transaction Id
NCS Parking	NCS Parking Tran History	Serial Nbr
NCS Parking	NCS Parking Tran History	Card Seq
NCS Parking	NCS Parking Tran History	Use Type
NCS Parking	NCS Parking Tran History	Sv Transaction
NCS Parking	NCS Parking Tran History	Sv Remaining
NCS Parking	NCS Parking Tran History	Rail Entry Dtm
NCS Parking	NCS Parking Tran History	Rail Entry Device
NCS Parking	NCS Parking Tran History	Rail Entry Mezz
NCS Parking	NCS Parking Tran History	Rail Exit Dtm
NCS Parking	NCS Parking Tran History	Rail Exit Device
NCS Parking	NCS Parking Tran History	Rail Exit Mezz
NCS Parking	NCS Parking Tran History	Rider Class
NCS Parking	NCS Parking Tran History	Negative Parking Flag
NCS Parking	NCS Parking Tran History	Inserted Dtm
NCS Parking	NCS Parking Tran History	Participant Transit Day
NCS Parking	NCS Parking Tran History	Stop Point Id
NCS Parking	NCS Parking Tran History	Use Transaction Type
NCS Parking	NCS Parking Tran History	Transaction Status Cd
NCS Parking	NCS Parking Tran History	Fare Table Id
NCS Parking	NCS Parking Tran History	Product Use Load Id
NCS Parking	NCS Parking Tran History	Facid
NCS Parking	NCS Parking Tran History	Device Num
NCS Parking	NCS Parking Tran History	Free Card
NCS Parking	NCS Parking Tran History	amount If Charged
NCS Parking	NCS Parking Tran History	Organization Code
NCS Parking	NCS Parking Tran History	Category Code
NCS Parking	NCS Parking Tran History	Nonmetro Rider Flag
NCS Parking	NCS Parking Tran History	Abuse Flag
NCS Parking	NCS Parking Tran History	Control Date
NCS Parking	NCS Parking Tran History	Participant Transit Day: Year
NCS Parking	NCS Parking Tran History	Participant Transit Day: Quarter
NCS Parking	NCS Parking Tran History	Participant Transit Day: Month
NCS Parking	NCS Parking Tran History	Participant Transit Day: Day
NCS Parking	NCS Parking Tran History	NCS Parking Date -> NCS Parking Tran History

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Parking	NCS Parking Tran History	NCS Parking Facility -> NCS Parking Tran History
NCS Parking	NCS Parking Tran History	NCS Rider Class -> NCS Parking Tran History
NCS Parking	NCS Parking Tran History	Mfg Serial Nbr
NCS Parking	NCS Parking Tran History	NCS Free Cards -> NCS Parking Tran History
NCS Parking	NCS Reason	Reason
NCS Parking	NCS Region	Code
NCS Parking	NCS Region	Description
NCS Parking	NCS Region Mezz	Region Code
NCS Parking	NCS Region Mezz	Mezz
NCS Parking	NCS Status	Status
NCS Parking	NCS Transaction Status	Transaction Status Cd
NCS Parking	NCS Transaction Status	Short Description
NCS Parking	NCS Transaction Status	Include In Eod Use Txn Proc
NCS Rail O-D Ridership Analysis	D Agency	Id
NCS Rail O-D Ridership Analysis	D Agency	Description
NCS Rail O-D Ridership Analysis	D Date 2	Dateint
NCS Rail O-D Ridership Analysis	D Date 2	Dateday
NCS Rail O-D Ridership Analysis	D Date 2	Datemonthint
NCS Rail O-D Ridership Analysis	D Date 2	Datemonth
NCS Rail O-D Ridership Analysis	D Date 2	Quarter
NCS Rail O-D Ridership Analysis	D Date 2	Dateyear
NCS Rail O-D Ridership Analysis	D Date 2	Dayofweek
NCS Rail O-D Ridership Analysis	D Date 2	Dayofweeknum
NCS Rail O-D Ridership Analysis	D Date 2	Daytype
NCS Rail O-D Ridership Analysis	D Date 2	Holiday
NCS Rail O-D Ridership Analysis	D Date 2	Weeknum
NCS Rail O-D Ridership Analysis	D Date 2	Week
NCS Rail O-D Ridership Analysis	D Date 2	Servicetype
NCS Rail O-D Ridership Analysis	D Date 2	Adjday
NCS Rail O-D Ridership Analysis	D Date 2	Deviceservicetype
NCS Rail O-D Ridership Analysis	D Date 2	Daytypeid
NCS Rail O-D Ridership Analysis	D Date 2	Dateday: Year
NCS Rail O-D Ridership Analysis	D Date 2	Dateday: Quarter
NCS Rail O-D Ridership Analysis	D Date 2	Dateday: Month
NCS Rail O-D Ridership Analysis	D Date 2	Dateday: Day
NCS Rail O-D Ridership Analysis	D Date 2	Adjday: Year
NCS Rail O-D Ridership Analysis	D Date 2	Adjday: Quarter
NCS Rail O-D Ridership Analysis	D Date 2	Adjday: Month
NCS Rail O-D Ridership Analysis	D Date 2	Adjday: Day
NCS Rail O-D Ridership Analysis	D Fare Instrument	Fare Instrument Id
NCS Rail O-D Ridership Analysis	D Fare Instrument	Fare Instrument Description
NCS Rail O-D Ridership Analysis	D Fare Instrument	Rider Class Description

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Rail O-D Ridership Analysis	D Fare Instrument	Fare Instrument Type Description
NCS Rail O-D Ridership Analysis	D Fare Instrument	Ticket Type Description
NCS Rail O-D Ridership Analysis	D Fare Instrument	Monetary Inst Type Description
NCS Rail O-D Ridership Analysis	D Fare Instrument	Rider Class
NCS Rail O-D Ridership Analysis	D Fare Instrument	Fare Instrument Type Id
NCS Rail O-D Ridership Analysis	D Fare Instrument	Ticket Type Id
NCS Rail O-D Ridership Analysis	D Fare Instrument	Monetary Inst Type Id
NCS Rail O-D Ridership Analysis	D Manual Override	Id
NCS Rail O-D Ridership Analysis	D Manual Override	Description
NCS Rail O-D Ridership Analysis	D Media Type	Media Type Id
NCS Rail O-D Ridership Analysis	D Media Type	Media Type Description
NCS Rail O-D Ridership Analysis	D Mezzanine	Station
NCS Rail O-D Ridership Analysis	D Mezzanine	Zone
NCS Rail O-D Ridership Analysis	D Mezzanine	Segment
NCS Rail O-D Ridership Analysis	D Mezzanine	Line
NCS Rail O-D Ridership Analysis	D Mezzanine	Locale
NCS Rail O-D Ridership Analysis	D Mezzanine	Jurisdiction
NCS Rail O-D Ridership Analysis	D Mezzanine	Facid
NCS Rail O-D Ridership Analysis	D Mezzanine	Agency Id
NCS Rail O-D Ridership Analysis	D Mezzanine	Agency Name
NCS Rail O-D Ridership Analysis	D Mezzanine	Operator Id
NCS Rail O-D Ridership Analysis	D Mezzanine	Operator Name
NCS Rail O-D Ridership Analysis	D Mezzanine	Fac Description
NCS Rail O-D Ridership Analysis	D Mezzanine	Mezz Num
NCS Rail O-D Ridership Analysis	D Mezzanine	Mez Id
NCS Rail O-D Ridership Analysis	D Mezzanine	Mezzanine
NCS Rail O-D Ridership Analysis	D Mezzanine	Blue Line Weight
NCS Rail O-D Ridership Analysis	D Mezzanine	Green Line Weight
NCS Rail O-D Ridership Analysis	D Mezzanine	Orange Line Weight
NCS Rail O-D Ridership Analysis	D Mezzanine	Red Line Weight
NCS Rail O-D Ridership Analysis	D Mezzanine	Yellow Line Weight
NCS Rail O-D Ridership Analysis	D Mezzmile 1	Mezzmileint
NCS Rail O-D Ridership Analysis	D Mezzmile 1	Frommezz
NCS Rail O-D Ridership Analysis	D Mezzmile 1	Tomezz
NCS Rail O-D Ridership Analysis	D Mezzmile 1	Miles
NCS Rail O-D Ridership Analysis	D Mezzmile 1	Milelvl
NCS Rail O-D Ridership Analysis	D Mezzmile 1	Weekday Peak Periods
NCS Rail O-D Ridership Analysis	D Mezzmile 1	Weekday Off Peak Periods Wknd
NCS Rail O-D Ridership Analysis	D Negative Rail	Rail Id
NCS Rail O-D Ridership Analysis	D Negative Rail	Rail
NCS Rail O-D Ridership Analysis	D Operator	Operator Id
NCS Rail O-D Ridership Analysis	D Operator	Descriptionription
NCS Rail O-D Ridership Analysis	D Operator	Operator Description
NCS Rail O-D Ridership Analysis	D Operator	Agency Id
NCS Rail O-D Ridership Analysis	D Product Use Load	Product Use Load Id

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Rail O-D Ridership Analysis	D Product Use Load	Product Use Load Description
NCS Rail O-D Ridership Analysis	D Product Use Load	Product Use Load Simple Description
NCS Rail O-D Ridership Analysis	D Product Use Load	Used By Linked Trips
NCS Rail O-D Ridership Analysis	D Rembal 1	Rembalint
NCS Rail O-D Ridership Analysis	D Rembal 1	Lowval
NCS Rail O-D Ridership Analysis	D Rembal 1	Highval
NCS Rail O-D Ridership Analysis	D Rembal 1	Rembal
NCS Rail O-D Ridership Analysis	D Time 2	Timeint
NCS Rail O-D Ridership Analysis	D Time 2	Hourinterval
NCS Rail O-D Ridership Analysis	D Time 2	Halfhourofday
NCS Rail O-D Ridership Analysis	D Time 2	Hourofday
NCS Rail O-D Ridership Analysis	D Time 2	Ampm
NCS Rail O-D Ridership Analysis	D Time 2	Hourint
NCS Rail O-D Ridership Analysis	D Time 2	Minutemin
NCS Rail O-D Ridership Analysis	D Time 2	Minutemax
NCS Rail O-D Ridership Analysis	D Time 2	Period
NCS Rail O-D Ridership Analysis	D Time 2	Peakflag
NCS Rail O-D Ridership Analysis	D Time 2	Halfhour24
NCS Rail O-D Ridership Analysis	D Time 2	Ampeak
NCS Rail O-D Ridership Analysis	D Transaction Status	Transaction Status Cd
NCS Rail O-D Ridership Analysis	D Transaction Status	Transaction Status Description
NCS Rail O-D Ridership Analysis	D Transaction Status	Used By Clearing
NCS Rail O-D Ridership Analysis	D Transaction Status	Used By Sales Counts
NCS Rail O-D Ridership Analysis	D Transaction Status	Used By Sales Values
NCS Rail O-D Ridership Analysis	D Transaction Status	Include In Eod Sale Txn Proc
NCS Rail O-D Ridership Analysis	D Transaction Status	Include In Eod Use Txn Proc
NCS Rail O-D Ridership Analysis	D Transaction Status	Used By Linked Trips
NCS Rail O-D Ridership Analysis	D Transaction Status	Card In Use Flag
NCS Rail O-D Ridership Analysis	D Use Type	Use Type
NCS Rail O-D Ridership Analysis	D Use Type	Use Type Description
NCS Rail O-D Ridership Analysis	D Use Type	Affects Sv Liability
NCS Rail O-D Ridership Analysis	D Use Type	Count As Entry
NCS Rail O-D Ridership Analysis	D Use Type	Count As Exit
NCS Rail O-D Ridership Analysis	D Use Type	Free Entry Or Exit
NCS Rail O-D Ridership Analysis	D time period	Time period id
NCS Rail O-D Ridership Analysis	D time period	Time range
NCS Rail O-D Ridership Analysis	D time period	Time period Description
NCS Rail O-D Ridership Analysis	D time period	Time category Description
NCS Rail O-D Ridership Analysis	D time period	Day type id
NCS Rail O-D Ridership Analysis	D time period	Begin time
NCS Rail O-D Ridership Analysis	D time period	End time
NCS Rail O-D Ridership Analysis	D time period	Time priority id
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Year Month
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Agency
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Operator

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Media Type
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Fare Instrument
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Rider Class
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Fare Instrument Type
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ticket Type
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Monetary Inst Type
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Product Use Load
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Transaction Status
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Include In Eod Use Txn Proc
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Negative Rail
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Year
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Quarter
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Month
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Week
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Day
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Day Type
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Holiday
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Week Num
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Day of Week
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Date Service Type
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Hour Interval
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Half Hour Interval
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Am Pm
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Mezzanine
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Station
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Zone
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Segment
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Line
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent locale
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Jurisdiction
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Year
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Quarter
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Month
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Week
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Day
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Day Type
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Holiday
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Week Num
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Day of Week
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Date Service Type
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Am Pm
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Mezzanine
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Station
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Zone
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Segment

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Line
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Locale
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Jurisdiction
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Remaining Balance
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Mile Level
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Number Rider
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Fare Amount
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Remaining Amount
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Miles
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Travel Minutes
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Jobid
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Entdateday: Year
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Entdateday: Quarter
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Entdateday: Month
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Entdateday: Day
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Extdateday: Year
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Extdateday: Quarter
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Extdateday: Month
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Extdateday: Day
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	NCS Period Range
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	NCS Period Description
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	TNCS Period Category
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Weekday Peak Periods
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Weekday Off Peak Periods Wknd
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Blue Line Count
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Green Line Count
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Orange Line Count
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Red Line Count
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Yellow Line Count
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Quarter Hour Interval
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ent Time Period
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Hour Interval
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Half Hour Interval
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Quarter Hour Interval
NCS Rail O-D Ridership Analysis	Rail O-D Ridership	Ext Period
NCS Rail Ridership & Revenue	D Product Use Load 1	Product Use Load Id
NCS Rail Ridership & Revenue	D Product Use Load 1	Product Use Load
NCS Rail Ridership & Revenue	D Product Use Load 1	Product Use Load Simple Description
NCS Rail Ridership & Revenue	D Product Use Load 1	Used By Linked Trips
NCS Rail Ridership & Revenue	Date Rail	Dateint
NCS Rail Ridership & Revenue	Date Rail	Day
NCS Rail Ridership & Revenue	Date Rail	Year Month
NCS Rail Ridership & Revenue	Date Rail	Month
NCS Rail Ridership & Revenue	Date Rail	Quarter
NCS Rail Ridership & Revenue	Date Rail	Year

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Rail Ridership & Revenue	Date Rail	Day of Week
NCS Rail Ridership & Revenue	Date Rail	Day of Week Num
NCS Rail Ridership & Revenue	Date Rail	Daytype
NCS Rail Ridership & Revenue	Date Rail	Holiday
NCS Rail Ridership & Revenue	Date Rail	Week Number
NCS Rail Ridership & Revenue	Date Rail	Week Ending
NCS Rail Ridership & Revenue	Date Rail	Service Type
NCS Rail Ridership & Revenue	Date Rail	Adjusted day
NCS Rail Ridership & Revenue	Date Rail	Daytypeid
NCS Rail Ridership & Revenue	Facility Rail	Facid
NCS Rail Ridership & Revenue	Facility Rail	Agency Id
NCS Rail Ridership & Revenue	Facility Rail	Agency
NCS Rail Ridership & Revenue	Facility Rail	Operator Id
NCS Rail Ridership & Revenue	Facility Rail	Operator
NCS Rail Ridership & Revenue	Facility Rail	Facility
NCS Rail Ridership & Revenue	Facility Rail	Mezz Number
NCS Rail Ridership & Revenue	Facility Rail	Mez Id
NCS Rail Ridership & Revenue	Facility Rail	Mezzanine
NCS Rail Ridership & Revenue	Facility Rail	Station
NCS Rail Ridership & Revenue	Facility Rail	Zone
NCS Rail Ridership & Revenue	Facility Rail	Segment
NCS Rail Ridership & Revenue	Facility Rail	Line
NCS Rail Ridership & Revenue	Facility Rail	Locale
NCS Rail Ridership & Revenue	Facility Rail	Jurisdiction
NCS Rail Ridership & Revenue	Facility Rail	Blue Line Weight
NCS Rail Ridership & Revenue	Facility Rail	Green Line Weight
NCS Rail Ridership & Revenue	Facility Rail	Orange Line Weight
NCS Rail Ridership & Revenue	Facility Rail	Red Line Weight
NCS Rail Ridership & Revenue	Facility Rail	Yellow Line Weight
NCS Rail Ridership & Revenue	Fare Instrument 1	Fare Instrument Id
NCS Rail Ridership & Revenue	Fare Instrument 1	Fare Instrument
NCS Rail Ridership & Revenue	Fare Instrument 1	Rider Class
NCS Rail Ridership & Revenue	Fare Instrument 1	Fare Instrument Type
NCS Rail Ridership & Revenue	Fare Instrument 1	Ticket Type
NCS Rail Ridership & Revenue	Fare Instrument 1	Monetary Inst Type
NCS Rail Ridership & Revenue	Fare Instrument 1	Rider Class
NCS Rail Ridership & Revenue	Fare Instrument 1	Fare Instrument Type Id
NCS Rail Ridership & Revenue	Fare Instrument 1	Ticket Type Id
NCS Rail Ridership & Revenue	Fare Instrument 1	Monetary Inst Type Id
NCS Rail Ridership & Revenue	Fixed Time Period	Timeint
NCS Rail Ridership & Revenue	Fixed Time Period	Quarter Hour Interval
NCS Rail Ridership & Revenue	Fixed Time Period	Half Hour Interval
NCS Rail Ridership & Revenue	Fixed Time Period	Hour Interval
NCS Rail Ridership & Revenue	Fixed Time Period	Am Pm
NCS Rail Ridership & Revenue	Fixed Time Period	Hour

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Rail Ridership & Revenue	Fixed Time Period	Minutemin
NCS Rail Ridership & Revenue	Fixed Time Period	Minutemax
NCS Rail Ridership & Revenue	Fixed Time Period	Period
NCS Rail Ridership & Revenue	Fixed Time Period	Peak Flag
NCS Rail Ridership & Revenue	Fixed Time Period	Halfhour24
NCS Rail Ridership & Revenue	Fixed Time Period	Am Peak
NCS Rail Ridership & Revenue	Media Type 1	Id
NCS Rail Ridership & Revenue	Media Type 1	Media Type
NCS Rail Ridership & Revenue	NCS Time Period	Time Period Id
NCS Rail Ridership & Revenue	NCS Time Period	Time Range
NCS Rail Ridership & Revenue	NCS Time Period	Time Period
NCS Rail Ridership & Revenue	NCS Time Period	Time Category
NCS Rail Ridership & Revenue	NCS Time Period	Day Type Id
NCS Rail Ridership & Revenue	NCS Time Period	Begin Time
NCS Rail Ridership & Revenue	NCS Time Period	End Time
NCS Rail Ridership & Revenue	NCS Time Period	Time Priority Id
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Agency Id
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Operator Id
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Date Key
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Time Period Key
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Ncs Period Key
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Facid
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Media Type Id
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Product Use Load Id
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Fare Instrument Id
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Transaction Status Cd
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Negative Rail Id
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Control Date
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Regular Entry Count
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Transfer Count
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Exit Count
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Exit Amount

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Remaing Balance
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Blue Entry count
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Green Entry count
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Orange Entry count
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Red Entry count
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	Yellow Entry count
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	D Time 3 -> Rail Ridership & Revenue Totals
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	D Media Type 1 -> Rail Ridership & Revenue Totals
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	D Fare Instrument 1 -> Rail Ridership & Revenue Totals
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	D Facility Rail -> Rail Ridership & Revenue Totals
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	D Date Rail -> Rail Ridership & Revenue Totals
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	D Product Use Load 1 -> Rail Ridership & Revenue Totals
NCS Rail Ridership & Revenue	Rail Ridership & Revenue Totals	D Time Period -> Rail Ridership & Revenue Totals
NCS Sale by Payment Type	Atld Payment Type	type id
NCS Sale by Payment Type	Atld Payment Type	ATLD Payment Description
NCS Sale by Payment Type	D agency	id
NCS Sale by Payment Type	D agency	Agency Description
NCS Sale by Payment Type	D fare instrument	Fare instrument id
NCS Sale by Payment Type	D fare instrument	Fare instrument Description
NCS Sale by Payment Type	D fare instrument	Rider class Description
NCS Sale by Payment Type	D fare instrument	Fare instrument type Description
NCS Sale by Payment Type	D fare instrument	Ticket type Description
NCS Sale by Payment Type	D fare instrument	Monetary inst type Description
NCS Sale by Payment Type	D fare instrument	Rider class
NCS Sale by Payment Type	D fare instrument	Fare instrument type id
NCS Sale by Payment Type	D fare instrument	Ticket type id
NCS Sale by Payment Type	D fare instrument	Monetary inst type id
NCS Sale by Payment Type	D operator	Operator id
NCS Sale by Payment Type	D operator	Descriptionription
NCS Sale by Payment Type	D operator	Operator Description
NCS Sale by Payment Type	D operator	Agency id
NCS Sale by Payment Type	D transaction status	Transaction status cd
NCS Sale by Payment Type	D transaction status	Transaction status Description

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Sale by Payment Type	D transaction status	Used by clearing
NCS Sale by Payment Type	D transaction status	Used by sales counts
NCS Sale by Payment Type	D transaction status	Used by sales values
NCS Sale by Payment Type	D transaction status	Include in eod sale txn proc
NCS Sale by Payment Type	D transaction status	Include in eod use txn proc
NCS Sale by Payment Type	D transaction status	Used by linked trips
NCS Sale by Payment Type	D transaction status	Card in use flag
NCS Sale by Payment Type	SP Date	Dateint
NCS Sale by Payment Type	SP Date	Transit Day
NCS Sale by Payment Type	SP Date	Year Month
NCS Sale by Payment Type	SP Date	Month
NCS Sale by Payment Type	SP Date	Quarter
NCS Sale by Payment Type	SP Date	Year
NCS Sale by Payment Type	SP Date	Day of Week
NCS Sale by Payment Type	SP Date	Day of Week Num
NCS Sale by Payment Type	SP Date	Day Type
NCS Sale by Payment Type	SP Date	Holiday
NCS Sale by Payment Type	SP Date	Week Num
NCS Sale by Payment Type	SP Date	Week End
NCS Sale by Payment Type	SP Date	Service Type
NCS Sale by Payment Type	SP Date	Adjday
NCS Sale by Payment Type	SP Date	Deviceservicetype
NCS Sale by Payment Type	SP Date	Daytypeid
NCS Sale by Payment Type	SP Timeperiod	Periodkey
NCS Sale by Payment Type	SP Timeperiod	AM PM
NCS Sale by Payment Type	SP Timeperiod	Entperiod
NCS Sale by Payment Type	SP Timeperiod	Am Peak
NCS Sale by Payment Type	SP Timeperiod	Peak flag
NCS Sale by Payment Type	Sale transaction type	Sale transaction type
NCS Sale by Payment Type	Sale transaction type	Descriptionription
NCS Sale by Payment Type	Sale transaction type	Sale Transaction Type Description
NCS Sale by Payment Type	Sale transaction type	Simple Description
NCS Sale by Payment Type	Sp facility	Facid
NCS Sale by Payment Type	Sp facility	Fac Description
NCS Sale by Payment Type	Sp sale summary by payment	Agency id
NCS Sale by Payment Type	Sp sale summary by payment	Operator id
NCS Sale by Payment Type	Sp sale summary by payment	Date key
NCS Sale by Payment Type	Sp sale summary by payment	Facid
NCS Sale by Payment Type	Sp sale summary by payment	Poll pos
NCS Sale by Payment Type	Sp sale summary by payment	Sale transaction type
NCS Sale by Payment Type	Sp sale summary by payment	Fare instrument id
NCS Sale by Payment Type	Sp sale summary by payment	Device id
NCS Sale by Payment Type	Sp sale summary by payment	Transaction status cd
NCS Sale by Payment Type	Sp sale summary by payment	Periodkey
NCS Sale by Payment Type	Sp sale summary by payment	Cash flag

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Sale by Payment Type	Sp sale summary by payment	Credit flag
NCS Sale by Payment Type	Sp sale summary by payment	Debit flag
NCS Sale by Payment Type	Sp sale summary by payment	Stored value flag
NCS Sale by Payment Type	Sp sale summary by payment	Mag fc flag
NCS Sale by Payment Type	Sp sale summary by payment	Smartbenefits flag
NCS Sale by Payment Type	Sp sale summary by payment	Auto load flag
NCS Sale by Payment Type	Sp sale summary by payment	Cash Count
NCS Sale by Payment Type	Sp sale summary by payment	Cash Amount
NCS Sale by Payment Type	Sp sale summary by payment	Credit Count
NCS Sale by Payment Type	Sp sale summary by payment	Credit Amount
NCS Sale by Payment Type	Sp sale summary by payment	Debit Count
NCS Sale by Payment Type	Sp sale summary by payment	Debit Amount
NCS Sale by Payment Type	Sp sale summary by payment	SmartBenefits Count
NCS Sale by Payment Type	Sp sale summary by payment	SmartBenefits Amount
NCS Sale by Payment Type	Sp sale summary by payment	Trade in Count
NCS Sale by Payment Type	Sp sale summary by payment	Trade in Amount
NCS Sale by Payment Type	Sp sale summary by payment	Auto Load Count
NCS Sale by Payment Type	Sp sale summary by payment	Auto Load Amount
NCS Sale by Payment Type	Sp sale summary by payment	Trans Count
NCS Sale by Payment Type	Sp sale summary by payment	Sv Transaction Amount
NCS Sale by Payment Type	Sp sale summary by payment	Net Value
NCS Sale by Payment Type	Sp sale summary by payment	Atld Payment Type -> Sp sale summary by payment
NCS Sale by Payment Type	Sp sale summary by payment	D agency -> Sp sale summary by payment
NCS Sale by Payment Type	Sp sale summary by payment	D fare instrument -> Sp sale summary by payment
NCS Sale by Payment Type	Sp sale summary by payment	Sale transaction type -> Sp sale summary by payment
NCS Sale by Payment Type	Sp sale summary by payment	SP Date -> Sp sale summary by payment
NCS Sale by Payment Type	Sp sale summary by payment	D operator -> Sp sale summary by payment
NCS Sale by Payment Type	Sp sale summary by payment	SP Timeperiod -> Sp sale summary by payment
NCS Sale by Payment Type	Sp sale summary by payment	D transaction status -> Sp sale summary by payment
NCS Sale by Payment Type	Sp sale summary by payment	Sp facility -> Sp sale summary by payment
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Transfer Type
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Date Key
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Period Key
NCS Transfer Transactions	Bus-to-Bius Transfer Totals	Fare Instrument Id

Data Mart (Business Area)	Report Function/Type	Report Attributes
Analysis		
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Transaction Status Cd
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Control Date
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Agency Id
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Product Use Load Id
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Alp Txn Flag
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	From Operator Id
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	From Facid
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	From Bus Route Number
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	To Operator Id
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	To Facid
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	To Bus Route Number
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Count
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Fare
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Sv Remaining
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	Interval Between Transfer
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	D Fare Instrument 1 -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	D Transaction Status 1 -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	From Operator -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	To Operator -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	From Route All -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	To route all -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	D Date Bus -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	D Timeperiod Bus -> Bus-to-Bius Transfer Totals

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	D Product Use Load 2 -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	From Facility Bus -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Bius Transfer Totals	To Facility Bus -> Bus-to-Bius Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Tfr Type
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Date Key
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Time Period Key
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Ncs Period Key
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Fare Instrument Id
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Transaction Status Cd
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Control Date
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Agency Id
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Product Use Load Id
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Alp Txn Flag
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	From Operator Id
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	From Facid
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	From Bus Route Number
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	To Operator Id
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	To Facid
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Count
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Fare
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Sv Remaining
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	Interval Between Transfer
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	D Fare Instrument 1 -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	D Transaction Status 1 -> Bus-to-Rail Transfer Totals

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	From Operator -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	To Operator -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	To Facility Rail -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	From Route All -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	D Date Rail -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	D Timeperiod Rail -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	NCS Time Period -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	D Product Use Load 2 -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	Bus-to-Rail Transfer Totals	From Facility Bus -> Bus-to-Rail Transfer Totals
NCS Transfer Transactions Analysis	D Date Bus	Key
NCS Transfer Transactions Analysis	D Date Bus	Day
NCS Transfer Transactions Analysis	D Date Bus	Year Month
NCS Transfer Transactions Analysis	D Date Bus	Month
NCS Transfer Transactions Analysis	D Date Bus	Quarter
NCS Transfer Transactions Analysis	D Date Bus	Year
NCS Transfer Transactions Analysis	D Date Bus	Day Of Week
NCS Transfer Transactions Analysis	D Date Bus	Day Of Week Num
NCS Transfer Transactions Analysis	D Date Bus	Day Type
NCS Transfer Transactions Analysis	D Date Bus	Holiday
NCS Transfer Transactions Analysis	D Date Bus	Week Num
NCS Transfer Transactions Analysis	D Date Bus	Week Ending
NCS Transfer Transactions Analysis	D Date Bus	Service Type
NCS Transfer Transactions Analysis	D Date Rail	Dateint
NCS Transfer Transactions Analysis	D Date Rail	Day

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Transfer Transactions Analysis	D Date Rail	Year Month
NCS Transfer Transactions Analysis	D Date Rail	Month
NCS Transfer Transactions Analysis	D Date Rail	Quarter
NCS Transfer Transactions Analysis	D Date Rail	Year
NCS Transfer Transactions Analysis	D Date Rail	Day of Week
NCS Transfer Transactions Analysis	D Date Rail	Day of Week Num
NCS Transfer Transactions Analysis	D Date Rail	Day Type
NCS Transfer Transactions Analysis	D Date Rail	Holiday
NCS Transfer Transactions Analysis	D Date Rail	Week Num
NCS Transfer Transactions Analysis	D Date Rail	Week End
NCS Transfer Transactions Analysis	D Date Rail	Service Type
NCS Transfer Transactions Analysis	D Date Rail	Adj Day
NCS Transfer Transactions Analysis	D Date Rail	Day ty peid
NCS Transfer Transactions Analysis	D Fare Instrument 1	Fare Instrument Id
NCS Transfer Transactions Analysis	D Fare Instrument 1	Fare Instrument Description
NCS Transfer Transactions Analysis	D Fare Instrument 1	Rider Class Description
NCS Transfer Transactions Analysis	D Fare Instrument 1	Fare Instrument Type Description
NCS Transfer Transactions Analysis	D Fare Instrument 1	Ticket Type Description
NCS Transfer Transactions Analysis	D Fare Instrument 1	Monetary Inst Type Description
NCS Transfer Transactions Analysis	D Fare Instrument 1	Rider Class
NCS Transfer Transactions Analysis	D Fare Instrument 1	Fare Instrument Type Id
NCS Transfer Transactions Analysis	D Fare Instrument 1	Ticket Type Id
NCS Transfer Transactions Analysis	D Fare Instrument 1	Monetary Inst Type Id
NCS Transfer Transactions Analysis	D Product Use Load 2	Product Use Load Id
NCS Transfer Transactions Analysis	D Product Use Load 2	Product Use Load Description

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Transfer Transactions Analysis	D Product Use Load 2	Product Use Load Simple Description
NCS Transfer Transactions Analysis	D Product Use Load 2	Used By Linked Trips
NCS Transfer Transactions Analysis	D Timeperiod Bus	Period Key
NCS Transfer Transactions Analysis	D Timeperiod Bus	Period Description
NCS Transfer Transactions Analysis	D Timeperiod Bus	Time Range
NCS Transfer Transactions Analysis	D Timeperiod Bus	Begin Time
NCS Transfer Transactions Analysis	D Timeperiod Bus	End Time
NCS Transfer Transactions Analysis	D Timeperiod Rail	Period Key
NCS Transfer Transactions Analysis	D Timeperiod Rail	Am Pm
NCS Transfer Transactions Analysis	D Timeperiod Rail	Fixed Period
NCS Transfer Transactions Analysis	D Timeperiod Rail	Am Peak
NCS Transfer Transactions Analysis	D Transaction Status 1	Transaction Status Cd
NCS Transfer Transactions Analysis	D Transaction Status 1	Transaction Status Description
NCS Transfer Transactions Analysis	D Transaction Status 1	Used By Clearing
NCS Transfer Transactions Analysis	D Transaction Status 1	Used By Sales Counts
NCS Transfer Transactions Analysis	D Transaction Status 1	Used By Sales Values
NCS Transfer Transactions Analysis	D Transaction Status 1	Include In Eod Sale Txn Proc
NCS Transfer Transactions Analysis	D Transaction Status 1	Include In Eod Use Txn Proc
NCS Transfer Transactions Analysis	D Transaction Status 1	Used By Linked Trips
NCS Transfer Transactions Analysis	D Transaction Status 1	Card In Use Flag
NCS Transfer Transactions Analysis	From Bus Route	Operator Id
NCS Transfer Transactions Analysis	From Bus Route	Route Number
NCS Transfer Transactions Analysis	From Bus Route	From Route
NCS Transfer Transactions Analysis	From Facility Bus	Facid
NCS Transfer Transactions Analysis	From Facility Bus	From Facility

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Transfer Transactions Analysis	From Facility Rail	Facid
NCS Transfer Transactions Analysis	From Facility Rail	Agency Id
NCS Transfer Transactions Analysis	From Facility Rail	Agency Name
NCS Transfer Transactions Analysis	From Facility Rail	Operator Id
NCS Transfer Transactions Analysis	From Facility Rail	Operator Name
NCS Transfer Transactions Analysis	From Facility Rail	from Facility
NCS Transfer Transactions Analysis	From Facility Rail	Mezz Num
NCS Transfer Transactions Analysis	From Facility Rail	Mez Id
NCS Transfer Transactions Analysis	From Facility Rail	From Mezzanine
NCS Transfer Transactions Analysis	From Facility Rail	From Station
NCS Transfer Transactions Analysis	From Facility Rail	From Zone
NCS Transfer Transactions Analysis	From Facility Rail	From Segment
NCS Transfer Transactions Analysis	From Facility Rail	From Line
NCS Transfer Transactions Analysis	From Facility Rail	From Locale
NCS Transfer Transactions Analysis	From Facility Rail	From Jurisdiction
NCS Transfer Transactions Analysis	From Facility Rail	Blue Line Weight
NCS Transfer Transactions Analysis	From Facility Rail	Green Line Weight
NCS Transfer Transactions Analysis	From Facility Rail	Orange Line Weight
NCS Transfer Transactions Analysis	From Facility Rail	Red Line Weight
NCS Transfer Transactions Analysis	From Facility Rail	Yellow Line Weight
NCS Transfer Transactions Analysis	From Operator	Operator Id
NCS Transfer Transactions Analysis	From Operator	Operator Descriptionription
NCS Transfer Transactions Analysis	From Operator	From Operator
NCS Transfer Transactions Analysis	From Operator	Agency Id
NCS Transfer Transactions Analysis	From Operator	From Agency

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Transfer Transactions Analysis	NCS Time Period	Time Period Id
NCS Transfer Transactions Analysis	NCS Time Period	NCS Time Range
NCS Transfer Transactions Analysis	NCS Time Period	NCS Time Period
NCS Transfer Transactions Analysis	NCS Time Period	NCS Time Category
NCS Transfer Transactions Analysis	NCS Time Period	Day Type Id
NCS Transfer Transactions Analysis	NCS Time Period	Begin Time
NCS Transfer Transactions Analysis	NCS Time Period	End Time
NCS Transfer Transactions Analysis	NCS Time Period	Time Priority Id
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Tfr Type
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Date Key
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Period Key
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Fare Instrument Id
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Transaction Status Cd
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Control Date
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Agency Id
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Product Use Load Id
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Alp Txn Flag
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	From Operator Id
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	From Facid
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	To Operator Id
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	To Facid
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	To Bus Route Number
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Count
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Fare
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Sv Remaining

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	Interval Between Transfer
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	D Fare Instrument 1 -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	D Transaction Status 1 -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	From Operator -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	To Operator -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	From Facility Rail -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	To route all -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	D Date Bus -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	D Timeperiod Bus -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	D Product Use Load 2 -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	Rail-to-Bus Transfer Totals	To Facility Bus -> Rail-to-Bus Transfer Totals
NCS Transfer Transactions Analysis	To Bus Route	Operator id
NCS Transfer Transactions Analysis	To Bus Route	Route number
NCS Transfer Transactions Analysis	To Bus Route	To Route
NCS Transfer Transactions Analysis	To Facility Bus	Facid
NCS Transfer Transactions Analysis	To Facility Bus	To Facility
NCS Transfer Transactions Analysis	To Facility Rail	Facid
NCS Transfer Transactions Analysis	To Facility Rail	Agency Id
NCS Transfer Transactions Analysis	To Facility Rail	Agency Name
NCS Transfer Transactions Analysis	To Facility Rail	Operator Id
NCS Transfer Transactions Analysis	To Facility Rail	Operator Name
NCS Transfer Transactions Analysis	To Facility Rail	To Facility
NCS Transfer Transactions Analysis	To Facility Rail	Mezz Num
NCS Transfer Transactions Analysis	To Facility Rail	Mez Id

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS Transfer Transactions Analysis	To Facility Rail	To Mezzanine
NCS Transfer Transactions Analysis	To Facility Rail	To Station
NCS Transfer Transactions Analysis	To Facility Rail	To Zone
NCS Transfer Transactions Analysis	To Facility Rail	To Segment
NCS Transfer Transactions Analysis	To Facility Rail	To Line
NCS Transfer Transactions Analysis	To Facility Rail	To Locale
NCS Transfer Transactions Analysis	To Facility Rail	To Jurisdiction
NCS Transfer Transactions Analysis	To Facility Rail	Blue Line Weight
NCS Transfer Transactions Analysis	To Facility Rail	Green Line Weight
NCS Transfer Transactions Analysis	To Facility Rail	Orange Line Weight
NCS Transfer Transactions Analysis	To Facility Rail	Red Line Weight
NCS Transfer Transactions Analysis	To Facility Rail	Yellow Line Weight
NCS Transfer Transactions Analysis	To Operator	Operator Id
NCS Transfer Transactions Analysis	To Operator	Operator Descriptionription
NCS Transfer Transactions Analysis	To Operator	To Operator
NCS Transfer Transactions Analysis	To Operator	Agency Id
NCS Transfer Transactions Analysis	To Operator	To Agency
NCS_METROACCESS	D Datel	Dateint
NCS_METROACCESS	D Datel	Day
NCS_METROACCESS	D Datel	Year Month
NCS_METROACCESS	D Datel	Month
NCS_METROACCESS	D Datel	Quarter
NCS_METROACCESS	D Datel	Year
NCS_METROACCESS	D Datel	Day of Week
NCS_METROACCESS	D Datel	Day of Week Num
NCS_METROACCESS	D Datel	Day Type
NCS_METROACCESS	D Datel	Holiday
NCS_METROACCESS	D Datel	Week Num
NCS_METROACCESS	D Datel	Week End
NCS_METROACCESS	D Datel	Service Type
NCS_METROACCESS	D Datel	Adjday
NCS_METROACCESS	D Datel	Deviceservicetype

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS_METROACCESS	D Datel	Daytypeid
NCS_METROACCESS	D operator 1	Operator id
NCS_METROACCESS	D operator 1	Descriptionription
NCS_METROACCESS	D operator 1	Operator Description
NCS_METROACCESS	D operator 1	Agency ID
NCS_METROACCESS	D operator 1	Agency Description
NCS_METROACCESS	MA Detail Trans History	Operator ID
NCS_METROACCESS	MA Detail Trans History	Facid
NCS_METROACCESS	MA Detail Trans History	Device ID
NCS_METROACCESS	MA Detail Trans History	Transaction Date Time
NCS_METROACCESS	MA Detail Trans History	Transaction ID
NCS_METROACCESS	MA Detail Trans History	Serial Number
NCS_METROACCESS	MA Detail Trans History	Fare Instrument ID
NCS_METROACCESS	MA Detail Trans History	Card Seq
NCS_METROACCESS	MA Detail Trans History	Use Type
NCS_METROACCESS	MA Detail Trans History	Sv Transaction
NCS_METROACCESS	MA Detail Trans History	Sv Remaining
NCS_METROACCESS	MA Detail Trans History	Transaction Status Cd
NCS_METROACCESS	MA Detail Trans History	Control date
NCS_METROACCESS	MA Detail Trans History	Participant transit day
NCS_METROACCESS	MA Detail Trans History	Rider Class
NCS_METROACCESS	MA Detail Trans History	Period key
NCS_METROACCESS	MA Detail Trans History	Date key
NCS_METROACCESS	MA Detail Trans History	D Datel -> MA Detail Trans History
NCS_METROACCESS	MA Detail Trans History	D operator 1 -> MA Detail Trans History
NCS_METROACCESS	MA Detail Trans History	MA Mezzanine -> MA Detail Trans History
NCS_METROACCESS	MA Detail Trans History	Transit facility -> MA Detail Trans History
NCS_METROACCESS	MA Detail Trans History	MA Transaction Status -> MA Detail Trans History
NCS_METROACCESS	MA Detail Trans History	MA Rider Class -> MA Detail Trans History
NCS_METROACCESS	MA Detail Trans History	MA Use Type -> MA Detail Trans History
NCS_METROACCESS	MA Detail Trans History	MA Timeperiod -> MA Detail Trans History
NCS_METROACCESS	MA Mezzanine	Station
NCS_METROACCESS	MA Mezzanine	Zone
NCS_METROACCESS	MA Mezzanine	Segment
NCS_METROACCESS	MA Mezzanine	Default Line
NCS_METROACCESS	MA Mezzanine	Locale
NCS_METROACCESS	MA Mezzanine	Jurisdiction
NCS_METROACCESS	MA Mezzanine	Facid
NCS_METROACCESS	MA Mezzanine	Mezznbr

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS_METROACCESS	MA Mezzanine	Mezid
NCS_METROACCESS	MA Mezzanine	Mezname
NCS_METROACCESS	MA Mezzanine	Blue Line Weight
NCS_METROACCESS	MA Mezzanine	Green Line Weight
NCS_METROACCESS	MA Mezzanine	Orange Line Weight
NCS_METROACCESS	MA Mezzanine	Red Line Weight
NCS_METROACCESS	MA Mezzanine	Yellow Line Weight
NCS_METROACCESS	MA Rider Class	class
NCS_METROACCESS	MA Rider Class	Rider Class Description
NCS_METROACCESS	MA Summary	Operator id
NCS_METROACCESS	MA Summary	Facid
NCS_METROACCESS	MA Summary	Device id
NCS_METROACCESS	MA Summary	Use Type
NCS_METROACCESS	MA Summary	Transaction Status Code
NCS_METROACCESS	MA Summary	Control date
NCS_METROACCESS	MA Summary	Rider Class
NCS_METROACCESS	MA Summary	Period key
NCS_METROACCESS	MA Summary	Date key
NCS_METROACCESS	MA Summary	Trans Count
NCS_METROACCESS	MA Summary	D Datel -> MA Summary
NCS_METROACCESS	MA Summary	D operator 1 -> MA Summary
NCS_METROACCESS	MA Summary	MA Mezzanine -> MA Summary
NCS_METROACCESS	MA Summary	Transit facility -> MA Summary
NCS_METROACCESS	MA Summary	MA Transaction Status -> MA Summary
NCS_METROACCESS	MA Summary	MA Rider Class -> MA Summary
NCS_METROACCESS	MA Summary	MA Use Type -> MA Summary
NCS_METROACCESS	MA Summary	MA Timeperiod -> MA Summary
NCS_METROACCESS	MA Timeperiod	Periodkey
NCS_METROACCESS	MA Timeperiod	AM PM
NCS_METROACCESS	MA Timeperiod	Period
NCS_METROACCESS	MA Timeperiod	AM Peak
NCS_METROACCESS	MA Timeperiod	Entpeakflag
NCS_METROACCESS	MA Transaction Status	Transaction status cd
NCS_METROACCESS	MA Transaction Status	Transaction Status Description
NCS_METROACCESS	MA Transaction Status	Used by clearing
NCS_METROACCESS	MA Transaction Status	Used by sales counts
NCS_METROACCESS	MA Transaction Status	Used by sales values
NCS_METROACCESS	MA Transaction Status	Include in eod sale txn proc
NCS_METROACCESS	MA Transaction Status	Include in eod use txn proc
NCS_METROACCESS	MA Transaction Status	Used by linked trips
NCS_METROACCESS	MA Transaction Status	Card in use flag
NCS_METROACCESS	MA Use Type	Use type
NCS_METROACCESS	MA Use Type	Use Type Description
NCS_METROACCESS	MA Use Type	Affects sv liability

Data Mart (Business Area)	Report Function/Type	Report Attributes
NCS_METROACCESS	MA Use Type	Count as entry
NCS_METROACCESS	MA Use Type	Count as exit
NCS_METROACCESS	MA Use Type	Free entry or exit
NCS_METROACCESS	MetorAccess Free Cards	Mfg serial num
NCS_METROACCESS	MetorAccess Free Cards	Serial num
NCS_METROACCESS	Transit facility	Facid
NCS_METROACCESS	Transit facility	Agency id
NCS_METROACCESS	Transit facility	Transit facility type id
NCS_METROACCESS	Transit facility	Facility Description
NCS_METROACCESS	Transit facility	Descriptionription
NCS_METROACCESS	Transit facility	Road type
NCS_METROACCESS	Transit facility	Road number
NCS_METROACCESS	Transit facility	Road prefix
NCS_METROACCESS	Transit facility	Road name
NCS_METROACCESS	Transit facility	Road suffix
NCS_METROACCESS	Transit facility	City
NCS_METROACCESS	Transit facility	Community
NCS_METROACCESS	Transit facility	County
NCS_METROACCESS	Transit facility	Province
NCS_METROACCESS	Transit facility	State
NCS_METROACCESS	Transit facility	Postal code
NCS_METROACCESS	Transit facility	Country
NCS_METROACCESS	Transit facility	Operator id
NCS_METROACCESS	Transit facility	Authority id
NCS_METROACCESS	Transit facility	Contact name
NCS_METROACCESS	Transit facility	Contact phone number

17.2 Useful Nextfare 5 Fact and Dimenion Data

In conjunction with the Cubic Nexfare 5 data imported into the WMATA Data Warehouse, WMATA end users also find it useful to query specific fact and dimension data detail from within the Nextfare 5 Central System for reporting and reconciliation functions. Table 17-2**Error! Reference source not found.** presents the data structure of these “useful” Nextfare 5 Transactoion or “Fact” Data tables and the tables they reference. Table 17-3 presents the data structure of these “useful” Nextfare 5 Dimension or “Lookup” Data tables and the look up tables they reference.

Table 17-2 - Useful Nextfare 5 Transaction or “Fact” Data Table Structure

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
ALP_ENROLLMENT		
ALP_ENROLLMENT_ID		
BM_BENEFIT_TYPE_ID		

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
ENROLLMENT_STATUS_ID		ALP_ENROLLMENT_STATUS
FARE_INSTRUMENT_ID		FARE_INSTRUMENT
INSERTED_BY		SEC_EMPLOYEE
INSERTED_DTM		
LAST_STATUS_DTM		
LINKED_TO_BENEFIT		
SERIALIZED_BENEFIT_PK		
SERIAL_NBR		
UPDATED_BY		SEC_EMPLOYEE
UPDATED_DTM		
VELOCITY_LIMIT_AMOUNT		
VELOCITY_PERIOD_ID		ALP_VELOCITY_PERIOD
AUTOLOAD_MV	N/A	
ALP_ENROLLMENT_ID		ALP_ENROLLMENT
AUTOLOAD_ACTION_ID		AUTOLOAD_ACTION
AUTOLOAD_DELIVERY_STATE_ID		AUTOLOAD_DELIVERY_STATE
AUTOLOAD_EVENT_ID		
AUTOLOAD_FREQUENCY_ID		AUTOLOAD_FREQUENCY
AUTOLOAD_ORIGIN_ID		AUTOLOAD_ORIGIN
AUTOLOAD_TYPE_EIS_ID		AUTOLOAD_TYPE_EIS
AUTOLOAD_TYPE_ID		AUTOLOAD_TYPE
CANCELLED_DTM		
DELIVERED_DTM		
EIS_AUTOLOAD_EVENT_ID		
EXPIRED_STATE_DTM		
EXPIRY_DTM		
EXTERNAL_REFERENCE		
FARE_INSTRUMENT_ID		FARE_INSTRUMENT
INSERTED_BY		SEC_EMPLOYEE
INSERTED_DTM		
LAST_TRANSMITTED_DTM		
OPERATOR_ID		OPERATOR_MV
PAYMENT_TYPE_ID		PAYMENT_TYPE
RECURRING_ATLD_ENROLLMENT_ID		
RETRIEVAL_REF_NBR		
RIDES		
SERIAL_NBR		
THRESHOLD_ATLD_ENROLLMENT_ID		
UPDATED_BY		SEC_EMPLOYEE
UPDATED_DTM		
VALUE		
VELOCITY_PERIOD_ID		ALP_VELOCITY_PERIOD
BUS_RUN_RECORD	DAILY_BUS_RUN_DETAIL	

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
BUS_ID	BUS_ID	BUS
BYPASS_FLAG	BYPASS_FLAG	
CASHBOX_ID	CASHBOX_SERIAL_NBR	
N/A	CASH_VALUE_RECEIVED	
N/A	CLOSE_DTM	
DEVICE_ID	DEVICE_ID	DEVICE
DEVICE_TRANSACTION_ID	DEVICE_TRANSACTION_ID	
EMPLOYEE_ID	EMPLOYEE_ID	SEC_EMPLOYEE
EMPLOYEE_IDENTIFICATION	EMPLOYEE_IDENTIFICATION	SEC_EMPLOYEE
FACID	FACID	TRANSIT_FACILITY
FARE_LEVEL	N/A	FARE_LEVEL
INSERTED_DTM	INSERTED_DTM	
OPERATOR_ID	OPERATOR_ID	OPERATOR_MV
N/A	OVERPAY_VALUE_RECEIVED	
REASON_CODE	REASON_CODE	BUS_REASON_CODE
RECORD_CREATED_DTM	OPEN_DTM	
N/A	RIDERSHIP	
SEQ_NUM	SEQ_NUM	
TRIP_PARAM_ONE (Run - Not Used by WMATA)	RUN	
TRIP_PARAM_TWO (Route)	ROUTE_ID	LINE_ROUTE
TRIP_PARAM_THREE (Service_Type)	N/A	
TRIP_PARAM_FOUR (Block)	TRIP (WMATA uses this for the Block)	BLOCKS
N/A	SV_AUTOLOAD_VALUE_ADD	
N/A	SV_CASH_VALUE_ADD	
N/A	SV_TOTAL_VALUE_ADD	
N/A	SV_USED	
N/A	TOTAL_REVENUE	
N/A	TRANSIT_DAY	
N/A	UNDERPAY_VALUE_RECEIVED	
CASHBOX_TRACKING	DAILY_CASHBOX_DETAIL	
BUS_ID	BUS_ID	BUS
BYPASS_FLAG	BYPASS_FLAG	
CASHBOX_EVENT_ID	CASHBOX_EVENT_ID	CASHBOX_EVENT
CASHBOX_INSERTED_DTM	CASHBOX_INSERTED_DTM	
CASHBOX_REMOVED_DTM	CASHBOX_REMOVED_DTM	
CASHBOX_SERIAL_NBR	CASHBOX_SERIAL_NBR	
CASHBOX_TYPE_ID	CASHBOX_TYPE_ID	CASHBOX_TYPE
COUNT_100C	COUNT_100C	
COUNT_10B	COUNT_10B	
COUNT_10C	COUNT_10C	
COUNT_1B	COUNT_1B	
COUNT_1C	COUNT_1C	

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
COUNT_20B	COUNT_20B	
COUNT_20C	COUNT_20C	
COUNT_25C	COUNT_25C	
COUNT_2B	COUNT_2B	
COUNT_50B	COUNT_50B	
COUNT_50C	COUNT_50C	
COUNT_5B	COUNT_5B	
COUNT_5C	COUNT_5C	
COUNT_TOKENS	COUNT_TOKENS	
COUNT_TOKEN_1	COUNT_TOKEN_1	
COUNT_TOKEN_2	COUNT_TOKEN_2	
COUNT_TOKEN_3	COUNT_TOKEN_3	
COUNT_TOKEN_4	COUNT_TOKEN_4	
COUNT_TOKEN_5	COUNT_TOKEN_5	
COUNT_TOKEN_6	COUNT_TOKEN_6	
DEVICE_ID	DEVICE_ID	DEVICE
EMPLOYEE_ID	EMPLOYEE_ID	SEC_EMPLOYEE
EMPLOYEE_IDENTIFICATION	EMPLOYEE_IDENTIFICATION	SEC_EMPLOYEE
EVENT_DTM	EVENT_DTM	
FACID	FACID	TRANSIT_FACILITY
FAREBOX_ID	FAREBOX_ID	
N/A	FINANCIAL_BUSINESS_DAY	
INSERTED_DTM	INSERTED_DTM	
MESSAGE_ID	N/A	
OPERATOR_ID	OPERATOR_ID	OPERATOR_MV
PROBE_LANE	PROBE_LANE	
REMOVED_FROM_VAULT_DTM	REMOVED_FROM_VAULT_DTM	
N/A	VALUE_BILLS	
VALUE_CASH	VALUE_CASH	
N/A	VALUE_CASH_FROM_RUN_RECORD	
N/A	VALUE_COINS	
VALUE_TOKENS	N/A	
VAULTED_DTM	VAULTED_DTM	
VAULTED_FLAG	N/A	
VAULT_LANE	VAULT_LANE	
CASHVAULT	N/A	
BIN_SERIAL_NBR		
BUS_CBX_SERIAL_NBR		
BUS_ID		BUS
BYPASS_ALARM_FLAG		
CASHVAULT_ACTION_TYPE		CASHVAULT_ACTION_TYPE
COUNT_100B		
COUNT_100C		

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
COUNT_10B		
COUNT_10C		
COUNT_1B		
COUNT_1C		
COUNT_20B		
COUNT_25C		
COUNT_2B		
COUNT_50B		
COUNT_50C		
COUNT_5B		
COUNT_5C		
COUNT_TOKEN		
COUNT_TOKEN_1		
COUNT_TOKEN_2		
COUNT_TOKEN_3		
COUNT_TOKEN_4		
COUNT_TOKEN_5		
COUNT_TOKEN_6		
DEVICE_ID		DEVICE
DEVICE_TRANSACTION_ID		
INSERTED_DTM		
MESSAGE_ID		
OPERATOR_ID		OPERATOR_MV
PROBE_DTM		
PROBE_FLAG		
PROBE_NUM		
REVENUE		
VAULT_FLAG		
VAULT_NUM		
VAULT_REMOVE_FLAG		
CASHVAULT_EXT	N/A	
CASHBOX_ALARM_FLAG		
DEVICE_ID		DEVICE
INSERTED_DTM		
PROBE_NUM		
TRANSIT_DAY		
VAULT_NUM		
COMPONENT_AUDIT	N/A	
DEVICE_ID		DEVICE
DEVICE_TRANSACTION_ID		
EMPLOYEE_ID		SEC_EMPLOYEE
EMPLOYEE_IDENTIFICATION		SEC_EMPLOYEE
EMPLOYEE_SERIAL_NBR		SEC_EMPLOYEE

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
EVENT_DTM		
EVENT_SEQUENCE_NBR		
EVENT_TYPE_ID		COUNTER_EVENT_TYPE
INSERTED_DTM		
STATUS_BITS		
VAL_001 thru VAL_256 (depending on Device Type)		
CSC_PASS_LOAD	N/A	
ACTION_CD		LOAD_ACTION
AUTOLOAD_EVENT_ID		
CARD_SEQ		
CID_ID		
CSC_MFG_ID		
CSC_SOFT_NO		
CURRENT_AUTOLOAD_ID		
DAYS_VALID		
DEVICE_ID		DEVICE
EXPIRY_DTM		
INSERTED_DTM		
OPERATOR_ID		OPERATOR_MV
PRODUCT_OWNER_ID		
RENEWED_IN_ADVANCE		
RIDER_CLASS		RIDER_CLASSIFICATION_MV
RIDES_REMAINING		
SERIAL_NBR		
START_DTM		
TRANSACTION_DTM		
TRANSACTION_ID		
CSC_USE	N/A	
CARD_SEQ		
CSC_MFG_ID		
CSC_SOFT_NO		
CURRENT_AUTOLOAD_ID		
DEVICE_ID		DEVICE
EXPIRY_DTM		
INSERTED_DTM		
OPERATOR_ID		OPERATOR_MV
RENEWED_IN_ADVANCE		
RIDER_CLASS		RIDER_CLASSIFICATION_MV
SERIAL_NBR		
TRANSACTION_DTM		
TRANSACTION_ID		

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
TRANSFER_CODE		TRANSFER_CODE
CSC_VALUE_LOAD	N/A	
ACTION_CD		LOAD_ACTION
AUTOLOAD_EVENT_ID		
CARD_SEQ		
CSC_MFG_ID		
CSC_SOFT_NO		
DEVICE_ID		DEVICE
EXPIRY_DTM		
INSERTED_DTM		
OPERATOR_ID		OPERATOR_MV
RIDER_CLASS		RIDER_CLASSIFICATION_MV
SERIAL_NBR		
TRANSACTION_DTM		
TRANSACTION_ID		
DEVICE_EVENT_HISTORY	N/A	
BUS_ID		BUS
CLEARED_DTM		
DEVICE_ID		DEVICE
EMPLOYEE_ID		SEC_EMPLOYEE
EMPLOYEE_IDENTIFICATION		SEC_EMPLOYEE
EVENT_DTM		
EVENT_ID		EVENT
EVENT_STATE_TYPE_ID		EVENT_STATE_TYPE
FACID		TRANSIT_FACILITY
INSERTED_DTM		
MESSAGE_ID		
OPERATOR_ID		OPERATOR_MV
SEVERITY		
FARE_MEDIA_INIT_ISSUE	N/A	
ACTION		
AGENCY_ID		AGENCY_MV
AUTHORITY_ID		AUTHORITY_MV
CSC_SOFT_NO		
CURRENT_AUTOLOAD_ID		
DEVICE_ID		DEVICE
DEVICE_TRANSACTION_ID		
EIS_SERIAL_NBR		
EMPLOYEE_ID		SEC_EMPLOYEE
EXPIRY_DTM		
FARE_INSTRUMENT_ID		FARE_INSTRUMENT
INSERTED_DTM		
OPERATOR_ID		OPERATOR_MV

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
RIDER_CLASSIFICATION		RIDER_CLASSIFICATION_MV
SEQ_NBR		
SERIAL_NBR		
SV_REMAINING		
TRANSACTION_DTM		
TRANSACTION_ID		
TRANSACTION_STATUS_CD		TRANSACTION_STATUS
MAGNETIC_PASS_LOAD		
ACTION_CD		LOAD_ACTION
DAYS_VALID		
DEVICE_ID		DEVICE
EXPIRY_DTM		
INSERTED_DTM		
OPERATOR_ID		OPERATOR_MV
RIDES_REMAINING		
SERIAL_NBR		
START_DTM		
TRANSACTION_DTM		
TRANSACTION_ID		
MAGNETIC_USE	N/A	
CARD_PRINT_SEQ_NBR		
DEVICE_ID		DEVICE
EXPIRY_DTM		
INSERTED_DTM		
LAST_USED_MINUTES		
LAST_USE_LOCATION		
LAST_USE_OPERATOR		OPERATOR_MV
LAST_USE_TYPE		
LAST_USE_VALUE		
OPERATOR_ID		OPERATOR_MV
SERIAL_NBR		
TRANSACTION_DTM		
TRANSACTION_ID		
SERIAL_NBR		
TRANSACTION_DTM		
TRANSACTION_ID		
MAGNETIC_VALUE_LOAD	N/A	
ACTION_CD		LOAD_ACTION
DEVICE_ID		DEVICE
EXPIRY_DTM		
INSERTED_DTM		
OPERATOR_ID		OPERATOR_MV
SERIAL_NBR		

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
TRANSACTION_DTM		
TRANSACTION_ID		
VALUE		
VALUE_REMAINING		
OP_DEVICE_HARDWARE_MANIFEST	N/A	
COMPONENT_DESCRIPTION		
COMPONENT_SERIAL_NBR		
DEVICE_ID		DEVICE
DEVICE_TRANSACTION_ID		
EFFECTIVE_DTM		
INSERTED_DTM		
LAST_REPORTED_DTM		
OP_DEVICE_NTCIP_MANIFEST	N/A	
DEVICE_ID		DEVICE
DEVICE_TRANSACTION_ID		
INSERTED_DTM		
LAST_REPORTED_DTM		
MANIFEST_MSG_ID		
NAME		
PUBLISH_SET_ID		
RECONCILED		
TRANSACTION_DTM		
OP_DEVICE_NTCIP_TABLE	N/A	
CREATED_DTM		
DEVICE_ID		DEVICE
EFFECTIVE_DTM		
MESSAGE_ID		
MESSAGE_TYPE		
NOTE		
RECONCILED		
TRANSACTION_DTM		
OP_DEVICE_SOFTWARE_COMPONENT	N/A	
COMPONENT_FN		
COMPONENT_ID		
COMPONENT_SIZE		
CREATED_DTM		
DEVICE_ID		DEVICE
DEVICE_TYPE_ID		DEVICE_TYPE
EFFECTIVE_DTM		
MANIFEST_MSG_ID		
MSG_DEVICE_ID		
MSG_URL		
NOTE		

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
PUBLISH_SET_ID		
RECONCILED		
REVISION		
TRANSACTION_DTM		
VERSION		
OP_DEVICE_SOFTWARE_MANIFEST	N/A	
DEVICE_ID		DEVICE
DEVICE_TRANSACTION_ID		
INSERTED_DTM		
LAST_REPORTED_DTM		
MANIFEST_MSG_ID_UNUSED		
NAME		
PUBLISH_SET_ID		
RECONCILED		
TRANSACTION_DTM		
OP_NTCIP_MESSAGE	N/A	
CUR_END_DTM		
CUR_OP_ID		
CUR_START_DTM		
DEVICE_CONTROL_GROUP_ID		DEVICE_CONTROL_GROUP
FUTURE_END_DTM		
FUTURE_OP_ID		
FUTURE_START_DTM		
GLOBAL		
INSERTED_DTM		
MAJOR_VERSION		
MESSAGE_ID		
MESSAGE_TYPE		
MINOR_VERSION		
UPDATED_DTM		
OP_PUBLISH_CONFIG_SET	N/A	
CATEGORY		
CREATED_BY		SEC_EMPLOYEE
DESCRIPTION		
INSERTED_DTM		
MODIFIED_BY		SEC_EMPLOYEE
NAME		
PUBLISH_SET_ID		
UPDATED_DTM		
OP_PUBLISH_MANIFEST	N/A	
DEVICE_CONTROL_GROUP_ID		
INSERTED_DTM		
MESSAGE_ID		

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
PUBLISH_SET_ID		
UPDATED_DTM		
OP_PUBLISH_SET_X_CONFIG	N/A	
CONFIG_ID		
END_DTM		
PUBLISH_SET_ID		
PUBLISH_TYPE		
START_DTM		
OP_PUBLISH_SET_X_MESSAGE	N/A	
DEVICE_CONTROL_GROUP_ID		
INSERTED_DTM		
MESSAGE_ID		
PUBLISH_SET_ID		
OP_PUB_SET_X_SOFTWARE_MSG	N/A	
OP_ID		
PUBLISH_SET_ID		
OP_SOFTWARE_REPOSITORY	N/A	
COMPONENT_FN		
DATA		
FILE_CREATED_DTM		
FILE_EXT		
FILE_SIZE		
OP_ID		
OP_XML_REPOSITORY	N/A	
DATA		
DESCRIPTION		
MESSAGE_TYPE		
OP_ID		
PREZIPPED		
ZIP_DATA		
SALE_TRANSACTION	DAILY_SALES_DETAIL	
ACTION_CD	ACTION_CD	LOAD_ACTION
N/A	BILL_CASH_VALUE	
BUS_ID	BUS_ID	BUS
N/A	CARD_SEQ	
CASH_COLLECTED	CASH_VALUE	
N/A	COINS_CASH_VALUE	
DEVICE_ID	DEVICE_ID	DEVICE
EMPLOYEE_ID	EMPLOYEE_ID	SEC_EMPLOYEE
EMPLOYEE_IDENTIFICATION	EMPLOYEE_IDENTIFICATION	SEC_EMPLOYEE
FACID	FACID	TRANSIT_FACILITY
FARE_INSTRUMENT_ID	FARE_INSTRUMENT_ID	FARE_INSTRUMENT
FARE_LEVEL_ID	N/A	FARE_LEVEL

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
FARE_TABLE_ID	FARE_TABLE_ID	FARE_TABLE
INSERTED_DTM	INSERTED_DTM	
N/A	LOAD_TYPE_ID	LOAD_TYPE
MEDIA_TYPE_ID	N/A	MEDIA_TYPE
NET_VALUE	NET_VALUE	
OPERATOR_ID	OPERATOR_ID	OPERATOR_MV
N/A	OVERPAY_VALUE	
N/A	PASS_LOAD_VALUE	
N/A	PAYMENT_TYPE_ID	PAYMENT_TYPE
ROUTE_ID	ROUTE_ID	LINE_ROUTE
ROUTE_NUMBER	N/A	LINE_ROUTE
N/A	RUN_ID	
RUN_ROUTE_RECORD_IDENTIFIER	N/A	DAILY_BUS_RUN_DETAIL (SEQ_NUM)
SALE_TRANSACTION_TYPE	SALE_TRANSACTION_TYPE	SALE_TRANSACTION_TYPE
SERIAL_NBR	SERIAL_NBR	
SERVICE_TYPE	N/A	SERVICE_TYPE
SV_AMOUNT_USED	STORED_VALUE_VALUE	
N/A	SV_LOAD_VALUE	
N/A	SV_LOAD_CASH_VALUE	
SV_REMAINING	VALUE_REMAINING	
SV_TRANSACTION	SV_TRANSACTION_VALUE	
N/A	TOKEN_COUNT	
TRANSACTION_DTM	TRANSACTION_DTM	
TRANSACTION_ID	TRANSACTION_ID	
TRANSACTION_STATUS_CD	TRANSACTION_STATUS_CD	TRANSACTION_STATUS
N/A	TRANSIT_DAY	
N/A	UNDERPAY_VALUE	
SALE_TXN_ALP_OBJECT	N/A	
DEVICE_ID		DEVICE
FARE_INSTRUMENT_ID		FARE_INSTRUMENT
INSERTED_DTM		
OPERATOR_ID		OPERATOR_MV
PERIOD_END_DATE		
PERIOD_VALUE_REMAINING		
SERIAL_NBR		
TRANSACTION_DTM		
TRANSACTION_ID		
VELOCITY_PERIOD_ID		
VELOCITY_VALUE_LIMIT		
SUSPENDED_TXN	N/A	
DEVICE_ID		DEVICE
DEVICE_TYPE_ID		DEVICE_TYPE

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
EXCEPTION_STACK_TRACE		
FACILITY_ID		TRANSIT_FACILITY
FILE_NAME		
OPERATOR_ID		OPERATOR_MV
SUSPENDED_DTM		
SUSPENDED_NOTES		
SUSPENSE_REASON_CODE_ID		SUSPENSE_REASON_CODE
SUSPENDED_TXN_ID		
TRANSACTION_DTM		
TRANSACTION_ID		
TXN_BODY		
USE_TRANSACTION	DAILY_USE_DETAIL	
BUS_ID	BUS_ID	BUS
N/A	CARD_SEQ	
DEVICE_ID	DEVICE_ID	DEVICE
EMPLOYEE_ID	N/A	SEC_EMPLOYEE
EMPLOYEE_IDENTIFICATION	N/A	SEC_EMPLOYEE
FACID	FACID	TRANSIT_FACILITY
FARE_INSTRUMENT_ID	FARE_INSTRUMENT_ID	FARE_INSTRUMENT
FARE_LEVEL_ID	N/A	FARE_LEVEL
FARE_TABLE_ID	FARE_TABLE_ID	FARE_TABLE
INSERTED_DTM	INSERTED_DTM	
LAST_USE_OPERATOR_ID	LAST_USE_OPERATOR_ID	OPERATOR_MV
MEDIA_TYPE_ID		MEDIA_TYPE
NET_VALUE	N/A	
OPERATOR_ID	OPERATOR_ID	OPERATOR_MV
N/A	PASS_COUNT	
N/A	PASS_VALUE	
N/A	RIDES_REMAINING	
ROUTE_ID	ROUTE_ID	LINE_ROUTE
ROUTE_NUMBER	N/A	LINE_ROUTE
RUN_ROUTE_RECORD_IDENTIFIER	N/A	DAILY_BUS_RUN_DETAIL (SEQ_NUM)
N/A	RUN_ID	
SERIAL_NBR	SERIAL_NBR	
SERVICE_TYPE	SERVICE_TYPE	SERVICE_TYPE
SV_AMOUNT_USED	STORED_VALUE_VALUE	
SV_REMAINING	VALUE_REMAINING	
SV_TRANSACTION	N/A	
N/A	TOTAL_VALUE	
TRANSACTION_DTM	TRANSACTION_DTM	
TRANSACTION_ID	TRANSACTION_ID	
TRANSACTION_STATUS_CD	TRANSACTION_STATUS_CD	TRANSACTION_STATUS

Useful Nextfare5 Transaction or "Fact" Data:		
NEXTFARE MAIN Schema:	**NEXTFARE REPORT Schema:**	**Joins to Table:**
N/A	TRANSIT_DAY	
USE_TRANSACTION_TYPE	USE_TRANSACTION_TYPE	USE_TRANSACTION_TYPE
USE_TYPE	USE_TYPE	USE_TYPE
BUS_REVENUE_COUNTED	N/A	
COUNT_100C		
COUNT_10B		
COUNT_10C		
COUNT_1B		
COUNT_1C		
COUNT_20B		
COUNT_25C		
COUNT_2B		
COUNT_50B		
COUNT_50C		
COUNT_5B		
COUNT_5C		
COUNT_TOKEN_1		
COUNT_TOKEN_2		
COUNT_TOKEN_3		
COUNT_TOKEN_4		
COUNT_TOKEN_5		
COUNT_TOKEN_6		
DATE_CREATED		
DATE_UPDATED		
FACID		TRANSIT_FACILITY
REVENUE_DATE		

Table 17-3 - Useful Nextfare 5 Dimension or "Lookup" Data

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
ALP_ENROLLMENT_STATUS	
DESCRIPTION	
ENROLLMENT_STATUS_ID	
SHORT_DESC	
ALP_VELOCITY_PERIOD	
DESCRIPTION	
SHORT_DESC	
VELOCITY_PERIOD_ID	
AUTOLOAD_ACTION	
AUTOLOAD_ACTION_ID	
DESCRIPTION	
SHORT_DESC	

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
AUTOLOAD_CONTROL_TYPE	
AUTOLOAD_CONTROL_ID	
DESCRIPTION	
AUTOLOAD_DELIVERY_STATE	
AUTOLOAD_DELIVERY_STATE_ID	
DESCRIPTION	
SHORT_DESC	
AUTOLOAD_FREQUENCY	
AUTOLOAD_FREQUENCY_ID	
DESCRIPTION	
SHORT_DESC	
AUTOLOAD_ORIGIN	
AUTOLOAD_ORIGIN_ID	
DESCRIPTION	
SHORT_DESC	
AUTOLOAD_TYPE	
AUTOLOAD_TYPE_ID	
DESCRIPTION	
SHORT_DESC	
AUTOLOAD_TYPE_EIS	
AUTOLOAD_TYPE_EIS_ID	
DESCRIPTION	
BUS	
BUS_ID	
BUS_STATUS_ID	BUS_STATUS
DESCRIPTION	
FACID	TRANSIT_FACILITY
OPERATOR_ID	OPERATOR_MV
BUS_REASON_CODE	
DESCRIPTION	
REASON_CODE	
SHORT_DESC	
BUS_STATUS	
BUS_STATUS_ID	
DESCRIPTION	
SHORT_DESC	
CASHBOX_EVENT	
CASHBOX_EVENT_ID	
DESCRIPTION	
SHORT_DESC	
CASHBOX_TYPE	
CASHBOX_TYPE_ID	

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
DESCRIPTION	
SHORT_DESC	
CASHVAULT_ACTION_TYPE	
CASHVAULT_ACTION_TYPE	
DESCRIPTION	
SHORT_DESC	
COMPONENT_TYPE	
COMPONENT_TYPE_ID	
DESCRIPTION	
SHORT_DESC	
COUNTER_EVENT_TYPE	
DESCRIPTION	
EVENT_TYPE_ID	
SHORT_DESC	
COUNTER_ID_TO_REGISTER_MAP	
ACTIVE_FLAG	
DEVICE_TYPE_ID	DEVICE_TYPE
EIS_COUNTER_ID	
IMPLIED_DECIMAL	
REGISTER_COLUMN_NAME	
REGISTER_DESCRIPTION	
REGISTER_NBR	
REGISTER_TYPE	
SORT_ORDER	
DAY_TYPE	
DAY_TYPE_ID	
DESCRIPTION	
SHORT_DESC	
DEVICE	
BUS_ID	BUS
DESCRIPTION	
DEVICE_CONTROL_GROUP_ID	DEVICE_CONTROL_GROUP
DEVICE_ID	
DEVICE_TYPE_ID	DEVICE_TYPE
FACID	TRANSIT_FACILITY
OPERATOR_ID	OPERATOR_MV
SHORT_DESC	
UPDATED_DTM	
DEVICE_CONTROL_GROUP	
DESCRIPTION	
DEVICE_CONTROL_GROUP_ID	
DEVICE_CONTROL_GROUP_TYPE_ID	DEVICE_CONTROL_GROUP_TYPE
OPERATOR_ID	OPERATOR_MV

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
SHORT_DESC	
DEVICE_CONTROL_GROUP_TYPE	
DESCRIPTION	
DEVICE_CONTROL_GROUP_TYPE_ID	
SHORT_DESC	
DEVICE_TYPE	
DESCRIPTION	
DEVICE_TYPE_ID	
SHORT_DESC	
DIRECTION	
DESCRIPTION	
DIRECTION_ID	
SHORT_DESC	
DISPLAY_RESOURCE	
DESCRIPTION	
INSERTED_DTM	
RESOURCE_ID	
RESOURCE_TYPE	DISPLAY_RESOURCE_TYPE
UPDATED_DTM	
DISPLAY_RESOURCE_TYPE	
FIELD_NAME	
MESSAGE_NAME	
RESOURCE_TYPE	
EVENT	
COMPONENT_TYPE_ID	COMPONENT_TYPE
DESCRIPTION	
DISPLAY_RESOURCE_ID	DISPLAY_RESOURCE
EVENT_ID	
SEVERITY	
SHORT_DESC	
EVENT_STATE_TYPE	
DESCRIPTION	
EVENT_STATE_TYPE_ID	
SHORT_DESC	
FARE_ACTION	
ACTION_DISPLAY_INDEX	DISPLAY_RESOURCE
DESCRIPTION	
FARE_ACTION_CODE	FARE_ACTION_CODE
FARE_ACTION_ID	
FARE_INSTRUMENT_ID	FARE_INSTRUMENT
FARE_LEVEL_ID	FARE_LEVEL
SERVICE_TYPE	SERVICE_TYPE
SHORT_DESC	

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
TRANSFER_CODE	TRANSFER_CODE
TRANSFER_RULE_ID	TRANSFER_RULE
ZONES_CROSSED	
FARE_ACTION_CODE	
DESCRIPTION	
FARE_ACTION_CODE	
SHORT_DESC	
FARE_EQUIPMENT_KEY	
DESCRIPTION	
EQUIPMENT_KEY_ID	
SHORT_DESC	
FARE_INST_X_CATEGORY	
FARE_INSTRUMENT_CATEGORY_ID	FARE_INSTRUMENT_CATEGORY
FARE_INSTRUMENT_ID	FARE_INSTRUMENT
FARE_INST_X_TRANSFER_RULE	
FARE_INSTRUMENT_ID	FARE_INSTRUMENT
FARE_TABLE_ID	FARE_TABLE
MAPPED_VERSION	
TRANSFER_RULE_ID	TRANSFER_RULE
FARE_INSTRUMENT_CATEGORY	
DESCRIPTION	
FARE_INSTRUMENT_CATEGORY_ID	
SHORT_DESC	
FARE_INSTRUMENT_CHARGE_LISTS	
DESCRIPTION	
FARE_INST_CHARGE_LISTS_ID	
P2P_MATRIX_ID	USE_CHARGE_MATRIX
SHORT_DESC	
USE_CHARGE_LIST_ID	USE_CHARGE_LIST
ZONE_USE_CHARGE_LIST_ID	ZONE_USE_CHARGE_LIST
FARE_INSTRUMENT_TYPE	
DESCRIPTION	
FARE_INSTRUMENT_TYPE_ID	
PASS_START_DATE_TYPE	
PRODUCT_CATEGORY_ID	PRODUCT_CATEGORY
SHORT_DESC	
FARE_LEVEL	
ACTIVE_FLAG	
DESCRIPTION	
DISPLAY_INDEX	DISPLAY_RESOURCE
FARE_LEVEL_ID	FARE_LEVEL
FARE_MODE_ID	FARE_MODE

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
SHORT_DESC	
FARE_LEVEL_MAPPING	
FARE_LEVEL_ID	FARE_LEVEL
FARE_TABLE_ID	FARE_TABLE
SERVICE_TYPE	SERVICE_TYPE
TIME_CATEGORY_ID	TIME_CATEGORY
FARE_LEVEL_X_FARE_TABLE	
FARE_LEVEL_ID	FARE_LEVEL
FARE_TABLE_ID	FARE_TABLE
FARE_MEDIA_INVENTORY	
ACTION	HOTLIST_ACTIONS
AGENCY_ID	AGENCY_MV
AUTHORITY_ID	AUTHORITY_MV
AUTOLOAD_EVENT_ID	
BATCH_NUM	
CSC_SOFT_NO	
CURRENT_AUTOLOAD_ID	
EMPLOYEE_ID	SEC_EMPLOYEE
EMPLOYEE_IDENTIFICATION	SEC_EMPLOYEE
FARE_MEDIA_STATUS_ID	FARE_MEDIA_STATUS
INIT_DEVICE_ID	DEVICE
INIT_DTM	
INSERTED_DTM	
ISSUE_DEVICE_ID	DEVICE
ISSUE_DTM	
ISSUE_SEQ_NBR	
ISSUE_TRANSIT_DAY	
OPERATOR_ID	OPERATOR_MV
RIDER_CLASSIFICATION	RIDER_CLASSIFICATION_MV
SERIAL_NBR	
SV_REMAINING	
TRANSACTION_STATUS_CD	TRANSACTION_STATUS
FARE_MEDIA_STATUS	
DESCRIPTION	
FARE_MEDIA_STATUS_ID	
SHORT_DESC	
FARE_MODE	
DESCRIPTION	
FARE_MODE_ID	
SHORT_DESC	
FARE_TABLE	
ACTIVE_FLAG	
DEFAULT_FARE_LEVEL	FARE_LEVEL

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
DEFAULT_SERVICE_TYPE	SERVICE_TYPE
DEFAULT_TIME_CATEGORY	TIME_CATEGORY
DESCRIPTION	
FARE_TABLE_ID	FARE_TABLE
INSERTED_DTM	
IS_PUBLISHED	
OPERATOR_ID	OPERATOR_MV
SHORT_DESC	
UPDATED_DTM	
VALID_FLAG	
FARE_TABLE_X_FARE_ACTION	
FARE_ACTION_ID	FARE_ACTION
FARE_TABLE_ID	FARE_TABLE
FARE_TABLE_X_FARE_INSTRUMENT	
FARE_INSTRUMENT_ID	FARE_INSTRUMENT
FARE_INST_CHARGE_LISTS_ID	
FARE_TABLE_ID	FARE_TABLE
MAPPED_VERSION	
PURCHASE_CONTROL_ID	PURCHASE_CONTROL
USE_CONTROL_ID	USE_CONTROL
HOTLIST_ACTIONS	
ACTION	
ACTIVE_FLAG	
DESCRIPTION	
SHORT_DESC	
KEY_OPERATION	
DESCRIPTION	
EQUIPMENT_KEY_ID	FARE_EQUIPMENT_KEY
FARE_TABLE_ID	FARE_TABLE
SHORT_DESC	
LINE_ROUTE	
ACTIVE_FLAG	
DIRECTION_ID	DIRECTION
LINE_ROUTE_ID	
OPERATOR_ID	OPERATOR_MV
ROUTE_DESIGNATOR_INDEX	DISPLAY_RESOURCE
ROUTE_DISPLAY_INDEX	DISPLAY_RESOURCE
ROUTE_NUMBER	
SERVICE_TYPE_ID	SERVICE_TYPE
UPDATED_DTM	
LOAD_ACTION	
ACTION_CD	
DESCRIPTION	

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
SHORT_DESC	
SIMPLE_DESC	
USED_BY_MANUAL_ADJUSTMENT	
USED_BY_SALES_COUNTS	
USED_BY_SALES_VALUES	
LOAD_TYPE	
COUNT_AS_SALE	
DESCRIPTION	
LOAD_TYPE_ID	
SHORT_DESC	
SIMPLE_DESC	
USED_BY_INCOMPLETE_TXN	
USED_FOR_AUTOLOAD	
MEDIA_TYPE	
DESCRIPTION	
MEDIA_TYPE_ID	
SHORT_DESC	
TYPE_OF_MEDIA	
PASS_TYPE	
DESCRIPTION	
PASS_TYPE_ID	
SHORT_DESC	
PAYMENT_TYPE	
DESCRIPTION	
IN_BENEFIT_AMOUNT	
IN_CASH_COLLECTED	
IN_CR_DB_AMOUNT	
IN_NET_VALUE	
IN_SV_AMOUNT	
PAYMENT_TYPE_ID	
SHORT_DESC	
UI_DISPLAY_DESC	
USED_BY_MANUAL_ADJUSTMENT	
USED_BY_PATRON_ORDER	
USED_BY_WEB_SERVICE	
USED_COLLECTION_MGR	
USED_FOR_CLEARINGHOUSE	
USED_ONLINE	
PRODUCT_CATEGORY	
DESCRIPTION	
PRODUCT_CATEGORY_ID	
SHORT_DESC	
REASON_CODE	

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
DESCRIPTION	
REASON_CODE_ID	
SHORT_DESC	
REGISTER_TYPE	
DESCRIPTION	
REGISTER_TYPE	
SHORT_DESC	
SALE_TRANSACTION_TYPE	
DESCRIPTION	
SALE_TRANSACTION_TYPE	
SHORT_DESC	
SIMPLE_DESC	
SEC_EMPLOYEE	
ACTIVE_FLAG	
DEVICE_GROUP_ID	
EMPLOYEE_ID	
EMPLOYEE_IDENTIFICATION	
EMPLOYEE_SERIAL_NBR	
FIRST_NAME	
INACTIVE_REASON	
INSERTED_DTM	
LAST_NAME	
LOCKOUT_DTM	
LOGIN	
MIDDLE_NAME	
STATUS	
SERVICE_TYPE	
ACTIVE_FLAG	
DEFAULT_FLAG	
DESCRIPTION	
OPERATOR_ID	OPERATOR_MV
SERVICE_TYPE	
SHORT_DESC	
SUSPENDED_REASON_CODE	
IS_FATAL	
SUSPENSE_REASON_CODE_ID	
SUSPENSE_REASON_CODE_TX	
TIME_CATEGORY	
ACTIVE_FLAG	
DEFAULT_FLAG	
DESCRIPTION	
DISPLAY_RESOURCE_ID	DISPLAY_RESOURCE
OPERATOR_ID	OPERATOR_MV

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
SHORT_DESC	
TIME_CATEGORY_ID	
TIME_PERIOD	
ACTIVE_FLAG	
BEGIN_TIME	
CALENDAR_DATE	
CONFLICT_FLAG	
DAY_TYPE_ID	DAY_TYPE
DESCRIPTION	
END_DAY	
END_TIME	
SHORT_DESC	
START_DAY	
TIME_CATEGORY_ID	TIME_CATEGORY
TIME_PERIOD_ID	
TIME_PRIORITY_ID	TIME_PRIORITY
TIME_PRIORITY	
DESCRIPTION	
SHORT_DESC	
TIME_PRIORITY_ID	
TRANSACTION_STATUS	
DESCRIPTION	
INCLUDE_IN_EOD_SALE_TXN_PROC	
INCLUDE_IN_EOD_USE_TXN_PROC	
SHORT_DESC	
TRANSACTION_STATUS_CD	
USED_BY_CLEARING	
USED_BY_LINKED_TRIPS	
USED_BY_SALES_COUNTS	
USED_BY_SALES_VALUES	
TRANSFER_FARE_LEVEL	
ACTIVE_FLAG	
DESCRIPTION	
OPERATOR_ID	OPERATOR_MV
PROCESSING_CONTROL_ID	
SHORT_DESC	
TO_ASSIGN_TRANSFER_CODE_ID	
TRANSFER_FARE_LEVEL_ID	
USE_DEDUCT	
TRANSFER_RULE	
DESCRIPTION	
FROM_CONDITION	
FROM_STOPS_OR_ROUTES	LINE_ROUTE or STOP_POINT

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE MAIN Schema:	**Joins to Table:**
OPERATOR_ID	OPERATOR_MV
SHORT_DESC	
TO_CONDITION	
TO_STOPS_OR_ROUTES	LINE_ROUTE or STOP_POINT
TRANSFER_RULE_ID	
TRANSFER_TRIP_ADJUST	
TRANSFER_UPGRADE_INDEX	TRANSFER_UPGRADE
TRANSFER_VALIDITY	
TRANSFER_UPGRADE	
FARE_LEVEL_ID	FARE_LEVEL
FARE_TABLE_ID	FARE_TABLE
TRANSFER_CODE_ID	TRANSFER_CODE
TRANSFER_FARE_LEVEL_ID	TRANSFER_FARE_LEVEL
TRANSFER_UPGRADE_INDEX	TRANSFER_UPGRADE_INDEX
VALUE_BOARDING	
TRANSFER_UPGRADE_INDEX	
DESCRIPTION	
SHORT_DESC	
TRANSFER_UPGRADE_INDEX	
USE_CHARGE_MATRIX	
DESCRIPTION	
P2P_MATRIX_ID	
SAME_SECTOR_CHARGE_FLAG	
SHORT_DESC	
SYMMETRICAL_FLAG	
USE_TRANSACTION_TYPE	
DESCRIPTION	
SHORT_DESC	
USE_TRANSACTION_TYPE	
USE_TYPE	
AFFECTS_SV_LIABILITY	
COUNT_AS_ENTRY	
COUNT_AS_EXIT	
DESCRIPTION	
FREE_ENTRY_OR_EXIT	
SHORT_DESC	
USE_TYPE	
XFER_TAGIN_TIMES	
FARE_LEVEL_ID	FARE_LEVEL
FARE_TABLE_ID	FARE_TABLE
TIME	
TRANSFER_RULE_ID	TRANSFER_RULE

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE INTER NCS Schema:	**Joins to Table:**
AGENCY_MV	
ADDRESS_1	
ADDRESS_2	
AGENCY_DISPLAY_INDEX	DISPLAY_RESOURCE
AGENCY_ID	
CITY	
COUNTRY	
COUNTY	
DESCRIPTION	
PHONE_NUMBER	
POSTAL_CODE	
PROVINCE	
REGION_ID	
SHORT_DESC	
STATE	
AUTHORITY_MV	
ACTIVE_FLAG	
AUTHORITY_ID	
DESCRIPTION	
DISPLAY_RESOURCE_ID	DISPLAY_RESOURCE
REGION_ID	
SHORT_DESC	
DISPLAY_RESOURCE_REGIONAL	
DESCRIPTION	
INSERTED_DTM	
RESOURCE_ID	
RESOURCE_TYPE	DISPLAY_RESOURCE_TYPE
UPDATED_DTM	
FARE_INSTRUMENT	
ALLOW_LOCAL_OVERRIDES	
AUTOLOAD_CONTROL_ID	
AUTOLOAD_LOW_VALUE_THRESHOLD	
AUTOLOAD_PASS_THRESHOLD	
AUTOLOAD_RIDE_THRESHOLD	
CALENDAR_PASS_ID	
COUNT_SALE_AS_RIDE_FLAG	
DESCRIPTION	
DIRECTED_AUTOLOAD_BONUS_FLAG	
FARE_INSTRUMENT_ID	FARE_INSTRUMENT
FARE_INSTRUMENT_TYPE_ID	FARE_INSTRUMENT_TYPE
GEOGRAPHY_TYPE	
GEOGRAPHY_VALIDATION	

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE INTER NCS Schema:	**Joins to Table:**
GEOGRAPHY_VALIDITY	
INSTRUMENT_DISPLAY_INDEX	DISPLAY_RESOURCE
ISSUE_PRINT_DISPLAY_INDEX	DISPLAY_RESOURCE
MAX_TRANSFERS	
MEDIA_TYPE_ID	MEDIA_TYPE
MONETARY_INST_TYPE_ID	MONETARY_INST_TYPE
NUM_ZONES	
OPERATOR_ID	OPERATOR_MV
PURCHASE_AMOUNT	
PURCHASE_CONTROL_ID	PURCHASE_CONTROL
RECURRING_AUTOLOAD_BONUS_FLAG	
REFUND_TIMEOUT	
RIDER_CLASS	RIDER_CLASSIFICATION_MV
RIDE_LIMIT	
RIDE_LIMIT_DAILY_FLAG	
SHORT_DESC	
THRESHOLD_AUTOLOAD_BONUS_FLAG	
TICKET_TYPE_ID	TICKET_TYPE
TRIP_VALIDITY_TIME	
UPDATED	
USE_PRINT_DISPLAY_INDEX	DISPLAY_RESOURCE
VALIDITY_PERIOD	
VERSION	
FARE_INSTRUMENT_ALP_EXT	
FARE_INSTRUMENT_ID	FARE_INSTRUMENT
MAX_AGGREGATION_AMT	
MAX_BILLING_PERIOD	
MAX_NUMBER_OF_TXNS	
FARE_INSTRUMENT_GROUP	
DESCRIPTION	
FARE_INSTRUMENT_GROUP_ID	
SHORT_DESC	
FARE_INSTRUMENT_VERSIONS	
ALLOW_LOCAL_OVERRIDES	
AUTOLOAD_CONTROL_ID	
AUTOLOAD_LOW_VALUE_THRESHOLD	
AUTOLOAD_PASS_THRESHOLD	
AUTOLOAD_RIDE_THRESHOLD	
CALENDAR_PASS_ID	
COUNT_SALE_AS_RIDE_FLAG	
DESCRIPTION	
DIRECTED_AUTOLOAD_BONUS_FLAG	
FARE_INSTRUMENT_ID	FARE_INSTRUMENT

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE INTER NCS Schema:	**Joins to Table:**
FARE_INSTRUMENT_TYPE_ID	FARE_INSTRUMENT_TYPE
GEOGRAPHY_TYPE	
GEOGRAPHY_VALIDATION	
GEOGRAPHY_VALIDITY	
INSTRUMENT_DISPLAY_INDEX	DISPLAY_RESOURCE
ISSUE_PRINT_DISPLAY_INDEX	DISPLAY_RESOURCE
MAX_TRANSFERS	
MEDIA_TYPE_ID	MEDIA_TYPE
MONETARY_INST_TYPE_ID	MONETARY_INST_TYPE
NUM_ZONES	
OPERATOR_ID	OPERATOR_MV
PURCHASE_AMOUNT	
PURCHASE_CONTROL_ID	PURCHASE_CONTROL
RECURRING_AUTOLOAD_BONUS_FLAG	
REFUND_TIMEOUT	
RIDER_CLASS	RIDER_CLASSIFICATION_MV
RIDE_LIMIT	
RIDE_LIMIT_DAILY_FLAG	
SHORT_DESC	
THRESHOLD_AUTOLOAD_BONUS_FLAG	
TICKET_TYPE_ID	TICKET_TYPE
TRIP_VALIDITY_TIME	
UPDATED	
USE_PRINT_DISPLAY_INDEX	DISPLAY_RESOURCE
VALIDITY_PERIOD	
VERSION	
OPERATOR_MV	
AGENCY_ID	AGENCY_MV
DESCRIPTION	
OPERATOR_DISPLAY_INDEX	DISPLAY_RESOURCE
OPERATOR_ID	
SHORT_DESC	
PURCHASE_CONTROLS	
ADD_VALUE	
CREDIT_MIN	
DB_CR_ALLOWED	
DEBIT_MIN	
DESCRIPTION	
FARE_INSTRUMENT_GROUP_ID	FARE_INSTRUMENT_GROUP
GRACE_PERIOD	
GROUP_DISPLAY_INDEX	DISPLAY_RESOURCE
INITIAL_SV_PURSE	
MAX_ADD_VALUE	

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE INTER NCS Schema:	**Joins to Table:**
MAX_MULTI	
MAX_TRANSIT_STORED_VALUE_PURSE	
NUM_COUPON	
NUM_TOKENS	
OPERATOR_ID	OPERATOR_MV
PURCHASE_CONTROL_ID	PURCHASE_CONTROL
QUANTITY	
SHORT_DESC	
VALUE_COUPON	
VALUE_TOKEN	
RESTRICTION_CATEGORY	
DESCRIPTION	
RESTRICTION_CATEGORY_ID	
SHORT_DESC	
RIDER_CLASSIFICATION_MV	
DESCRIPTION	
DISPLAY_INDEX	DISPLAY_RESOURCE
RIDER_CLASS	
SHORT_DESC	
USED	
SELL_FARE_INSTRUMENT	
FARE_INSTRUMENT_ID	FARE_INSTRUMENT
OPERATOR_ID	OPERATOR_MV
TICKET_TYPE	
DESCRIPTION	
OPERATOR_ID	OPERATOR_MV
SHORT_DESC	
TICKET_TYPE_ID	
USE_WITH_MAGNETIC_FLAG	
TICKET_TYPE_X_RESTRICTION	
OPERATOR_ID	OPERATOR_MV
RESTRICTION_CATEGORY_ID	
TICKET_TYPE_ID	TICKET_TYPE
TRANSFER_CODE	
DESCRIPTION	
SHORT_DESC	
TRANSFER_CODE	
TRANSIT_FACILITY	
AGENCY_ID	AGENCY_MV
AUTHORITY_ID	AUTHORITY_MV
CITY	
CONTACT_NAME	
CONTACT_PHONE_NUMBER	

Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE INTER NCS Schema:	**Joins to Table:**
COUNTRY	
COUNTY	
DESCRIPTION	
FACID	TRANSIT_FACILITY
OPERATOR_ID	OPERATOR_MV
POSTAL_CODE	
ROAD_NAME	
ROAD_NUMBER	
SHORT_DESC	
STATE	
TRANSIT_FACILITY_TYPE_ID	TRANSIT_FACILITY_TYPE
TRANSIT_FACILITY_TYPE	
DESCRIPTION	
SHORT_DESC	
TRANSIT_FACILITY_TYPE_ID	
USE_FARE_INSTRUMENT	
FARE_INSTRUMENT_ID	FARE_INSTRUMENT
OPERATOR_ID	OPERATOR_MV
Useful Nextfare5 Dimension or "Lookup" Data	
NEXTFARE REPORT Schema:	**Joins to Table:**
BLOCKS	
BLOCK_ID	
FACID	TRANSIT_FACILITY
DESCRIPTION	